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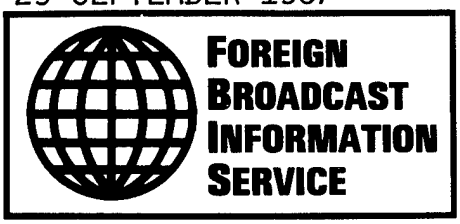

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Science & Technology

USSR: Computers

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SCIENCE & TECHNOLOGY

USSR: COMPUTERS

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/13046

REGARDING THE PAYMENT FOR SERVICES OF COMPUTER CENTERS

Moscow VESTNIK STATISTIKI in Russian No 3, Mar 87, pp. 37-38

[Article by A. Ivantsov, assistant director of the computer center of the Kostroma Oblast Statistical Authority]

[Text] The existing procedure of accounting for the cost of use of computer is based on the supposition that all the computer devices are in constant operation during the solving of any given assignment--from the input to the output of information. But in actuality, each individual device (with several exceptions) only participates in the actual process for a limited time, in accordance with the program. The devices are also different in terms of cost (from 3.5 thousand to hundreds of thousands of rubles).

The problem of a more intensive workload for all devices can be solved either technically or technologically by a multiprogram computer operation. It should be noted that the existing procedure of determining the cost of jobs and the established procedure for calculating the volume of computer jobs do not help the employees of self-financing computer centers (CC) in using intelligent techniques.

In reality, the payment for CC services is based on the time spent on the computer, the so-called machine time, which is registered in a special log. The entries in the log serve as the foundation in determining the work volume in machine-hours. Savings in machine time automatically translates into a lower work volume. Therefore, the members of the CC have no stake whatsoever in reducing the machine time spent on information processing, since the funds-producing factor is the work volume.

In order to establish the realistic expenses of the CC on electronic processing, the prices of machine-hours should be differentiated according to the workload intensity and cost of the individual devices.

For this, the price of one machine-hour of computer operation for a particular job must be defined as:

$$P_j = P \frac{\Sigma t_i \cdot C_i}{TC},$$

$\frac{\Sigma t_i \cdot C_i}{TC} =$

where K - can be taken as a correction factor for the cost of a machine-hour, differentiated in accordance with the workload of each computer device taking part in the job;

P_j - nominal machine-hour price for a specific job, taking into account the operating time of each computer device;

P - price of a machine-hour;

t_1 - operating time of an individual computer device, determined during the program testing phase;

C_i - net cost of an individual computer device;

T - total computer operating time in handling a specific job (from entry to output);

C - net cost of the computer (basic configuration).

The aggregate net cost should be defined as the product of the aggregate computer operating time in handling a specific job (T) by the nominal price of a machine-hour (P_j). The customer should be billed in terms of the prices set for a "physical" unit of work (a document-line, an action, a computation, etc.):

$$P_n = \frac{TP_j}{Q},$$

where P_n is the price of a unit of work volume, Q is the work volume in physical units.

Our calculations by the above method reveal a lowering of the net cost of work within the range of 15-20 percent, depending on the type of job.

For example, the running of the program "Operating Day of Stroybank" costs the Kostroma provincial branch of the construction bank 125 rubles daily (it is run for 1.67 h and the net cost of a machine-hour is 75 rubles).

Taking into account the workload of the individual devices of the YeS-1022 computer (cf. table), the nominal price of a machine-hour in this job will be:

$$P = 75 \text{ rubles} \cdot \frac{5.5 \text{ thousand rubles} \cdot 0.25 \text{ h} + 3.6 \text{ thousand rubles} \cdot 0.33 \text{ h} + \ldots}{398.0 \text{ thousand rubles} \cdot 1.67 \text{ h}}$$

$$\frac{+ 200 \text{ thousand rubles} \cdot 1.67 \text{ h}}{1} = 75 \text{ rubles} \cdot 0.798 = 59.85 \text{ rubles}.$$

Table. Workload of individual devices of YeS-1022 computer in computations of the "Operating Day of the Stroybank" at the computer center of the Kostroma Provincial Statistical Authority

Марка устройства a	Стоимость устройства, тыс. руб. b	Время работы, мин. c	Примечание d
1	2	3	4
ЕС 6019	7,7	—	e Не участвует в работе
ЕС 6022	5,5	15	
ЕС 5010	3,6	—	Не участвует в работе
ЕС 5010	3,6	20	
ЕС 5010	3,6	—	Не участвует в работе
ЕС 3222	50,0	100	
ЕС 5061	22,0	100	
ЕС 5061	22,0	36	
ЕС 5061	22,0	36	
ЕС 5561	12,6	100	
ЕС 7022	5,5	—	Не участвует в работе
ЕС 7010	10,4	—	Не участвует в работе
ЕС 7032	15,1	60	
ЕС 7077	5,7	100	
ЕС 2422	200,0	100	
ЕС 6012	5,9	—	Не участвует в работе
ЕС 5517	5,5	15	
ЕС 3222-02	50,0	—	Не участвует в работе
ЕС 7077	5,7	—	Не участвует в работе

Key:

a. Device model
b. Net cost of device, thousands of rubles
c. Operating time, min
d. Remarks
e. Not participating in the job

The net cost of the job, taking into account the workload of the individual computer devices, will be 1.67 h·59.85 rubles = 99.95 rubles, instead of the 125.25 rubles paid each day, i.e., the actual price for this job is overcharged by 15 rubles, 15 kopecks per machine-hour, and for the job as a whole each day 25 rubles, 30 kopecks are overcharged.

The same situation is also observed in the processing of statistical reports by computer.

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12717
CSO: 1863/292

PAY MICROCOMPUTER CENTERS OPENS WITH AGATS, MIKROSHAS

Moscow MOSKOVSKAYA PRAVDA in Russian 9 Dec 86 p 1

[Article by N. Slavutskaya, entitled "Dialogue With the Computer," under the "Rhythm of the Day" rubric]

[TExt] Yesterday in Timiryazevskiy region the first computer center in the country that is equipped with the domestically produced computers "Agat" and "Mikrosha" was opened.

Today, both in the technical vuzes and in many other schools, there is another language, BASIC, being studied, just like English or, for example, French. This is a language with which one converses with a computer. Would you like to learn it? Please, for this, it is only necessary to come to Dmitrovskoye Highway, 115, and for a small fee one can play with a computer, or if necessary, take up programming.

All of the first floor of the building is devoted to a fee-charging computer center. Technical documentation is arranged on magazine tables in the comfortable foyer, from which one can obtain one's first impressions of the machines and the programs they contain. There are three rooms in the center. In the first, 15 "Agat" machines are set up and are intended for computer games. In the second room, there are 10 more of these machines, but these are for programming. The third room is devoted to the "Mikrosha" machine, a daily use computer, which, by the way, will be manufactured at the Lianozovskiy Electromechanical Factory in large lots of several thousands and will be sold in specialty stores.

Drop into the first room. The computers are set up on the tables and each consists of a color terminal, a keyboard, and a system unit. At each table, there are two chairs, and so, in fact, more than one person can play with the computer. And it is nothing terrible if you do not know the language with which the computer speaks. There are expert consultants at the center, as well as teaching programs that are built into the "Agat" and the "Mikrosha."

The personal computer center was established by the Lianozovskiy Electromechanical Factory. Will the center be popular with Muscovites and will many of those who are willing find themselves spending their leisure time "in private" with a computer? A.A. Sukhanov, the computer-center representative of the General Director of the factory, responded to these questions.

In May of this year we opened one room with several machines, intended, it's true, only for computer games--related Albert Anatolyevich. There was no shortage of visitors, on the contrary, there were not enough machines. Therefore, we decided to open the center, and the Timiryazevskiy Regional Executive Committee picked out a convenient location for it. The new center is "under one roof" with the factory maintenance service, so there will not be any questions about servicing the machines. In regard to the importance of the center and the benefit it brings, probably no value amount can be given: It is a great help to the schools and universities, as well as to those involved with science. Moreover, the machine can work with text, which it can edit and print.

12863/13046
CSO: 1863/171

UDC 658.012.011.56:658.7/.8(520)

BOOK: AUTOMATIZATION OF THE PROCESSES OF INDUSTRIAL SUPPLY AND MARKETING BY JAPANESE FIRMS

Moscow MATERIALNO-TEKHNICHESKOYE SNABZHENIYE: SERIYA 3: PRIMENENIYE MATEMATICHESKIKH METODOY, VYCHISLITELNOY TEKHNIKI I ORGTEKHNIKI V MATERIALNO-TEKHNICHESKOM SNABZHENII. OBZORNAYA INFORMATSIYA in Russian No 1, 1987 pp 1-2, anno, 40

[Annotation, introduction and table of contents from book "Automatization of the Processes of Industrial Supply and Marketing by Japanese Firms," by Aleksandr Apollonovich Bashev and Andrey Nikolayevich Rodnikov, in the series "Material and Technical Supply: Series 3: Application of Mathematical Methods, Computer Technology and Organizational Technology to Material and Technical Supply," published by the Central Scientific Research Institute for Information and Technoeconomic Research on Material and Technical Supply (TsNIITEIMS) of the USSR State Committee for Material and Technical Supply (Gossnab SSSR), 1,930 copies, 40 pages]

[Text] Annotation

The authors examine the organizational structures of industrial management, supply and marketing employed in Japanese industrial firms. Taking as examples the automobile and electronics industries, they analyze the experience gained in the organization of manufacturing and material-technical support of industry under the "Kanban" system. They describe automated data processing systems for the marketing of the finished products of a number of Japanese firms. They also describe the provision of warehousing services to consumers of small parts for technologically advanced products. They examine the experience of a number of firms in the U.S. and Western Europe which have introduced into their manufacturing establishments principles of organization of manufacturing and supply which have been developed in Japan.

Introduction

In the Policy Report of the CPSU Central Committee to the 27th Congress of the Communist Party of the Soviet Union, Comrade M.S. Gorbachev pointed out that "the economic, financial and technological supremacy over its nearest rivals, which the U.S. enjoyed down through the very end of the 1960's, has been subjected to a serious testing. Western Europe and Japan have succeeded to a certain extent in making things tight for their American patron. They have

flung down a challenge to the United States, even in such a traditional sphere of American hegemony as the latest technology" (reference 1, page 15).

The so-called Japanese challenge of the 1970's and 1980's has led to a recognition in the West of distinct points of superiority in the organization of management in present-day Japan as compared with American management. Interest in Japanese methods of management in industrial production, supply and marketing, an interest observable throughout the world, has ben aroused primarily by the high performance levels achieved in Japan's economic growth in comparison with those of other capitalist countries. In 1973-1977 the average annual growth of Japan's gross national product in real figures amounted to 4.1 percent, while that of the U.S. was 2.9 percent. In 1978-1982 it was 4.5 percent, while in the U.S. it was only 1.6 percent. In 1985 it was 4.6 percent, but for the U.S., 2.2 percent (reference 4, page 26; reference 12, pages 98, 110 and 145).

For a long time Japan had the highest rate of growth of productivity of labor among the developed capitalist countries. The savings rate in Japan has for many years been the highest in the world, at the level of 30 percent. (In the U.S. and Great Britain it is lower nearly by half, while in West Germany, France and Canada it is lower by one-third.) Despite all this, Japan still significantly lags behind the U.S. in the overall capacity of its economic and scientific-technical potential, in the degree of integration of development of its national economy, and in the efficiency of production. The Japanese economy has its own serious problems: severe dependence on imports of raw materials and energy resources, and on exports of finished goods (more than half of the finished products of some sectors of the machine tool industry are exported), inadequate development of the service sector, relatively low labor productivity in domestic wholesale and retail trade, etc.

Later on, we will examine the most important features of the organization of industrial management and the automatization of the processes of supply and marketing of the products of Japanese firms operating primarily in the field of the automotive and electronics industries, that is, in the sectors in which Japan at the present time securely occupies the leading position in the world.

We will examine the experience of industrial firms in the U.S. and Western Europe which have successfully introduced into their manufacturing establishments principles of organization of production, supply and marketing which have been developed in Japan. In this survey we make use of statistical data from the works of the Soviet researchers V.K. Dermanov, L.I. Yevenko, and Yu.N. Karpov, published in 1985-1986 (references 3, 4 and 5), and data from the foreign periodical press for 1982-1986.

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13289/13046
CSO: 1863/261

COMPUTER SYSTEM TAKES IN ORAL SPEECH

Leningrad TASS in Russian 21 Feb 87

[Text] Specialists at the Leningrad Institute of Informatics and Automation of the USSR Academy of Sciences have developed an electronic system capable of apprehending oral speech.

"Initially, we fed into the computer memory 100 words together with the standards of their sounds," Yuri Kosyrev, head of the research effort, told TASS. "But sensing acoustic signals by the computer is just the first stage in understanding the text. Due to the peculiarities of the pronunciation and outside noise we identify only 70 percent of the sounds when we speak with each other.

"Virtually everything that was said becomes clear after a subconscious analysis of the context. We have built our device according to the same pattern. In contrast to its analogs, including those developed abroad, it comprehends not only separate words but also semantic regularities and senses associative relationships."

This process was demonstrated to the TASS correspondent. A dictator pronounced a control phrase: "Repeat the text seven times." The phrase instantly appeared on the display screen. In this instance, and this is symptomatic for the computer, a mistake was made at an acoustic level. The device heard something different because of the inarticulate pronunciation. It instantly built up several hypotheses of the phrase. Relying on the most probable associations of words fed into its memory, the computer rejected the wrong version.

Each man sitting before the microphone names his occupation: fitter, designer, research, so that the computer could orientate itself towards a definite terminology. This way the system can be taught in several days to work in one or another industry. Experiments are planned for this year to apply it at research centers.

The created device will become a major element of the fifth-generation computer. Work on its development is supposed to be finalized in the USSR early next decade.

/13046
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UDC 62-50:007:65

STANDARDIZED AUTOMATA. I.

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 2 Dec 85) pp 32-42

[Article by Yu.V. Kapitonova and A.T. Mishchenko]

[Abstract] Standardization of hardware has many advantages. This article develops and extends a method for synthesizing controlling automata presented in previous articles. Various types of flip-flops are analyzed as memory elements increasing the degree of universalization of the standardized portions of the automata. Possibilities are noted for simplifying the supplementary circuits of the automata. Standardized automata with discrete and continuous motion are analyzed. Figures 8; references: 7 Russian.

6508/13046
CSO: 1863/198

THE SOL/YeS TRANSLATING SYSTEM, ORIENTED TOWARD MODELING OF COMPLEX SYSTEMS

Kishinev IZVESTIYA AKADEMII NAUK MOLDAVSKOY SSR. SERIYA FIZIKO-TEKHNICHESKIKH NAUK in Russian No 3, 1986 (manuscript received 6 Mar 86) pp 54-55

[Article by G.A. Magariu, M.N. Marichuk and T.L. Tofan]

[Abstract] The Institute of Mathematics and The Computer Center, Moldavian SSR, have developed the SOL/YeS translating system for automation of work with simulation models. The SOL discrete modeling language has a small set of simple but flexible facilities which form a powerful apparatus for the description of complex system models, decreasing labor consumption and time required to create and debug models. The system is based on the principle of syntactic control of the translation process, with the syntax of the language assigned by KU-grammar formalism, combining the phases of lexical and syntactic analysis. The system has been introduced at the Institute of Applied Geophysics, State Commission on Hydrology and Meteorology, and is used to investigate information interactions in an automated helio-geophysical system. References 2: 1 Russian, 1 Western.

6508/13046
CSO: 1863/251

UDC 007:519.271

INFLUENCE OF DISTRIBUTION OF TIME OF RESTORATION OF PROTECTION ON RELIABILITY OF PROTECTED SYSTEMS

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 1 Oct 84) pp 124-126

[Article by L.S. Stoykova and O.A. Yushchenko]

[Abstract] A previous article studied the influence of the distribution of time of repair of protection on the probability of failure-free operation of a protective system. This article utilizes the same model to construct precise upper and lower limits for the probability of failure-free operation of a system with protection for all possible distributions of the time of repair of the protection with a fixed mean. The boundaries allow a well-founded

conclusion concerning the influence of the distribution of time to repair of protection on the probability of failure-free operation of the system with protection. References: 1 Russian.

6508/13046
CSO: 1863/198

UDC 519.2

DECISION MAKING BASED ON ANALYSIS OF A DECISION TREE WITH INCOMPLETE INFORMATION

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 29 Jul 83) pp 113-120

[Article by G.Kh. Babich]

[Abstract] Formalized procedures intended for decision making with incomplete information must be suitable for description of situations in spite of information incompleteness. This article is based on a method of decision-tree analysis suggested by Schlaifer for the case when full information is available on the statistical characteristics of the object. The method is briefly discussed and developed for conditions of incomplete information. Problems of construction of the tree system of software are analyzed and an example of its application is presented. Figures 5; references 4: 3 Russian, 1 Western.

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CSO: 1863/198

UDC 519.854

ALGORITHM FOR SOLVING THE PROBLEM OF OPTIMIZING RELIABILITY OF A COMPLEX SYSTEM USING DISSIMILAR REDUNDANT ELEMENTS IN SUBSYSTEMS

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 15 Aug 85) pp 54-61, 81

[Article by V.L. Volkovich and V.A. Zaslavskiy]

[Abstract] An algorithm is suggested for solving the problem of optimal computation of redundancy considering limitations on resources for systems in which failures of individual subsystems do not always result in failure of the entire system. Redundancy of subsystems in these systems, in contrast to traditional redundancy, is achieved by utilization of dissimilar redundant elements. A system of programs that has been developed and implemented as a part of the DISON dialogue automatic planning system for the structures of complex technical entities based on the reliability criterion. References 14: 12 Russian, 2 Western.

6508/13046
CSO: 1863/198

UDC 007:512.98

REGULARIZATION OF THE PROBLEM OF RECOGNITION OF OBJECTS AND PHENOMENA

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 27 Mar 85) pp 103-105

[Article by A.L. Gorelik]

[Abstract] More than 200 algorithms have been developed to date for determination of optimal decision rules in pattern recognition problems. These methods virtually all fail to consider the possibility of error in measurement of the characteristics upon which the rules are based. This article discusses the question of regularizing the problem as applicable to the probabilistic approach to pattern recognition. The concepts of regularized first and second order errors and regularized mean Bayes risk are introduced. References: 3 Russian.

6508/13046
CSO: 1863/198

UDC 51:621.391

ALGEBRAIC INTERPRETATION OF R-GRAPHS

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 23 Dec 83) pp 17-21

[Article by V.Yu. Kayurov]

[Abstract] A new approach to the organization of the production of programs known as R-Programming Technology has been developed over the past decade at the Ukrainian Institute of Cybernetics under the leadership of V.M. Glushkov. One of the characteristics of the method is graphic representation of the program product in all stages of development. Programs are represented as oriented, loaded graphs called R-graphs or R-diagrams. The development of the programming project is considered as a process of successive hierarchical detail development of R-graphs, during which names of programs on lines of graphs are expanded either as independent R-graphs or text in the programming language directly implemented in the computer. R-graphs can also be used in theoretical study of the formal properties of algorithms. This article discusses this range of problems, analysis of R-graphs from the standpoint of their meta-algorithmic capabilities. An algebra is described which fully encompasses the range of problems related to equivalency and formal transformation of R-graphs and provides the necessary strictness of the concept of the R-graph as a meta-algorithmic facility. References: 7 Russian.

6508/13046
CSO: 1863/198

UNIVERSAL COMPUTER-AIDED DESIGN SYSTEM

Moscow TASS in Russian 12 Mar 87

[Text] A principally new approach to creating computer-aided design systems, SAPR, was suggested by scientists of the Machine Science Institute of the USSR Academy of sciences. They are working on software for a Universal CAD system which can design a space station, an aircraft, a car or a lathe.

Until now the CAD systems have been largely developed in the world to meet the needs of specific productions or enterprises. It took several years to create a CAD system. A group of Moscow scientists under the guidance of Professor Stanislav Dobrynin are working on a universal CAD system whose computer will need only information on performance characteristics and production technology to produce a design of a new machine.

"We will provide the design bureau of an enterprise, equipped with a small computer center, with a 'skeleton' system. Engineers at the plant will have no difficulty in adding 'flesh' to it using sectoral data banks," Professor Dobrynin told a TASS correspondent. "Moreover, one does not need special knowledge of programming to work with such a computer."

The new Soviet computer-aided design system optimizes the creative work of the designer freeing him from routine work. In designing parts of machines and mechanisms, it can also design technology for its production. In addition to ready drafts, it also prepares programs for numerically-controlled machine tools recorded on magnetic disks or a perforated tape.

/13046
CSO: 1863/244-E

UDC 531.77:681.5

METHODS OF DETERMINING ORIENTATION OF OBJECTS IN ROBOT VISION SYSTEMS

Moscow IZMERENIYA, KONTROL, AVTOMATIZATSIYA in Russian No 2, 1986 pp 36-45

[Article by Candidate of Technical Sciences S.A. Kuzmin]

[Abstract] The requirements for robot vision systems to be used to automate industrial processes include speed, reliable determination of part type, universality, simplicity and ease of learning, minimum sensitivity to changing light and contrast, the ability to work with microcomputers, small size and weight, and low cost. One of the most important functions of robot vision is determination of the orientation of objects on a surface. This review studies the major methods and equipment used to determine the orientation of objects on a surface such as table or conveyor, with primary emphasis on algorithms used. Methods based on analysis of two dimensional brightness functions, contour analysis and analysis of local peculiarities are described. Many highly specialized and interactive methods of determination of orientation have been developed, creating great difficulties in adjustment of robot vision systems to new batches of parts. Analysis of methods of determining the orientation of objects shows that the most promising is the spectral-arch method, which can automate many operations involved in adjustment of the system during the learning stage, eliminating the need for a qualified specialist during this phase. The method is applicable to arbitrary shapes and allows determination of the orientation of an object as well as the side of the object turned toward the sensor. Figures 3; references 23: 14 Russian, 9 Western.

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PRODUCTION IMPLEMENTATION OF INDUSTRY BRANCH INFORMATION RETRIEVAL SYSTEM

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 87 pp 28-31

[Article by Candidates of Technical Sciences A.I. Shkolnik and L.L. Shumlyanskaya, under the "Economics and Organization of Production" rubric]

[Text] Scientific and technical achievements and experience of advanced enterprises in plastic processing field should be systematized, in order to broaden the scope of industrial application thereof and to carry out a unified technical policy. Plastic parts, made by extrusion and injection molding, are produced by enterprises that belong to over 80 Ministries and agencies. These parts have different consumer properties and design and technological characteristics. The assortment of molded and extruded plastic parts consists of hundreds of thousands of items and is renewed by 5 to 15% annually.

This situation created an objective need for developing an information system as an instrument for collecting and summarizing advanced production experience (first within the Minkhimprom [Ministry of Chemical Industry]).

Experience has demonstrated that in order to solve the most important design, technological and economic problems with the goal of more efficient control of multinomenclature production of plastic parts, the system should use modern computers, whereas the data bank should have sufficient software.

In the first place, one should solve problems of technological preparation of production, but problems of technical and economic planning are equally important.

An automated information retrieval system AIPS-PLASTIK, developed at NPO [Scientific and Production Association] "Plastik", makes it possible to scientifically control the technical level of production of plastic parts that is scattered nomenclature-wise, territorially and organizationally (see article by V.V. Abramov and A.I. Shkolnik "Automated Information Retrieval System for Control of Technical Level of Production of Plastic Parts", EKSPRESS-INFORMATSIYA NIITEKhIM [Scientific Research Institute of Technical Information in Chemical Industry], SERIYA "PERERABOTKA PLASTMASS", 1981, No 8, pp 1-4). AIPS-PLASTIK is designed for providing professionals at enterprises and scientific-research, design and other organizations with real-time documented and factographic information on the assortment of products by

industry branch, on manufacturing technology and technical and economic indices (TEP).. The system performs the following functions:

organization and support of two-way communications with enterprises that have departments and shops for processing of plastics;

organization and maintenance of the information reference bank on machine media;

improvement and organization of the fund of algorithms and programs for computerized solution of a complex of information-retrieval and problem-oriented problems;

indexing of subject queries, automated retrieval and compiling answers for users.

The AIPS is based on the Source Documents Center (TsPD), where the following information is stored: factual data on the existing assortment of plastic parts, manufactured by Minkhimprom factories (in prospective, other industries will be covered as well), standard and reference documentation, drawings, catalogs and manuals. The NPO "Plastik" information-computer center (IVTs), where a data bank in an M-4030 computer has been created, forms the technical basis of the AIPS.

Information is prepared on unified forms, filled out at factories, then documents and drawings are transfered to TsPD for compiling and initial processing. During the initial processing the documents are recorded and checked for correctness, errors are corrected and indices are coded. During the next stage, documents arrive at the IVTs, where perforation is performed and input information is recorded on magnetic disks. After computerized processing, source documents are returned to TsPD for compilation and storage, wherefrom they are made available to users on request.

NPO "Plastik" supplies unified document forms and instruction and methodological materials to factories and helps them in personnel training.

Professionals at enterprises and organizations submit queries to the AIPS on a standard form that lists subscriber's (user's) attributes and the query expiration date, search keys and objects and computer printout format of the requested information. A subscriber can request data on any initial index recorded in unified and standard-reference documents or from the known list of derived indices, as well as on results of solving problem-oriented problems. Documented information retrieval is possible, when the user receives on request a computer printout of any source document, entered in the system, or gets copies of documents and drawings.

In addition to answering queries, the AIPS solves on a computer a complex of problem-oriented problems. The most important problems are:

referring, at the production preparation stage, to analogs of plastic parts, in order to adopt state-of-the-art technical achievements;

determining the number of machines, required for production introduction of new products;

analyzing actual and standard TEP and identifying reserves for reducing material and technical costs;

performing cost and profit analysis and identifying unprofitable products;

improving the system of industry branch technical and economic standards;

maintaining wholesale price lists for plastic products;

forming NSI [reference information on standards] for designing manufacturing processes and tooling.

The structure of AIPS-PLASTIK software has been described in great detail (see Abramov, V.V., Yakovlev, M.F., Shkolnik, A.I., Ovchinnikov, E.V. et al, "Metodika informatsionnogo obespecheniya avtomatizirovannogo banka dannykh po izdeliyam iz plastmass" [Methodlology of Software Support of Automated Data Bank on Plastic Products], Cherkassy, 1979).

Information, arriving from enterprises, has a conditionally-variable character and is recorded within the framework of a system of unified documents, specifically developed for the AIPS, while taking into account existing information flows at enterprises.

The main source document, a "Part Certificate", is filled out at the industry branch enterprises for each molded or extruded part at during the product introduction. The face page of the certificate lists attributes, required for describing general data, design and technological characteristics and the shape of the part, manufacturing parameters and production equipment. The back page of the certificate contains the part cost accounting information by production departments. All in all, the certificate contains about 100 indices that make it possible to solve the majority of the above problems. Currently the AIPS fund contains over 12,000 of such certificates.

Standard-reference information, stored in the system, has a conditionally-constant character and includes standard reference books and price lists, classifiers and codifiers of principal information nomenclatures, and dictionaries of key and recoding criteria of information, used in describing products, equipment, tooling etc.

All unified documents, classifiers and dictionaries are included in the automated portion of the system and are supplemented by a manual file of source documents and parts and molds drawings. The AIPS fund also has classifiers of ancillary and automation equipment and manuals of molds and non-standard equipment.

The main objective of the AIPS is automated realization of the retrieval-reference function as a means for meeting the users' demand at various levels. In order to meet this objective, a maximally flexible and efficient software (PO) system is required that would guarantee data bank functioning and the

possibility to use it for controlling a given production process. The most important elements in the AIPS structure are application and problem software, designed for servicing users - professionals at scientific research divisions of the institute and at enterprises.

In general, queries from the institute professionals are information retrieval problems of three types:

determining reasonable application fields for new scientific and technical developments in the field of technology;

design and economic problems in production of plastic parts;

sampling stastistical data from the AIPS fund in order to plot factor dependences and develop standards. On the average, 150-200 of these types of queries are realized in the AIPS annually.

As a rule, professionals at enterprises are interested in the possibility to adopt the state-of-the-art experience, when introducing new products or improving existing technology, as well as in having analogs of new products, in order to determine the price and to ensure the highest quality category certification. This work is performed regularly, in accordance with an established procedure (see Shkolnik, A.I., Kireyev, G.I., Grinblat, V.N. and Rippa, S.P. "Choosing Prototypes of Plastic Parts for Adopting State-of-the-Art Experience of Enterprises", TEKHNOLOGIYA PERERABOTKI TERMOPLASTOV I REAKTOPLASTOV, Moscow, NIITEKhIM, 1984, pp 69-83), because from 500 to 800 new plastic parts are being introduced annually.

Improvement of existing processes is an equally important direction in the area of managing the technical level of production. This work is performed in following stages: analyzing reserves of current technology; developing technical proposals for improving production; implementing organizational and technical measures, aimed at improving economic efficiency.

The first stage is realized in the AIPS by comparing actual and standard TEP, in order to identify products with low economic efficiency in manufacturing. At present, programs for computerized analysis of the technical level of production have been developed and are used. These programs employ a set of industry standards on consumption of raw materials, the cost of molding-extrusion, molds wear and the cost of manufacturing thereof. Using results of the annual analysis of actual and standard TEP, the institute professionals identify, with the help of the AIPS, products with low economic efficiency, develop technical proposals for improving corresponding production processes and establish, together with enterprises, priorities for practical implementation of these proposals.

The mass and expeditious character of performing the above work, using the AIPS, makes it possible for the institute professionals to render more efficient help to enterprises in the industry on specific directions of the scientific and technical progress. Actual savings in 1984 due to the application of AIPS-PLASTIK were equal to about 380,000 R.

Along with the above positive results, shortcomings of the automated portion were detected in the process of production operation of the AIPS that have determined the further development of the system.

Technical shortcomings are due to the limited memory and slow speed of the M-4030 computer, which makes it impossible to organize an efficient multiprogram mode and thus teleprocessing of information, that are required for an industry-level system.

The system (DOS-ASVT) and application (PPP NSI-1) software has the following shortcomings:

it is impossible to organize efficient data teleprocessing in the DOS operating system environment;

if one wants to work with several information files simultaneously or to perform arithmetic operations for data processing, one must write additional modules for the PPP NIS-1 DOS in the ASSEMBLER language;

long data retrieval time, because the PPP NIS-1 DOS only makes it possible to work with sequential and index-sequential files, whereas for solving the majority of problems random access is required;

problem data redundancy, characteristic of the method for organizing information in the form of files.

All of the above called for conveting the automated portion of the AIPS into the OS YeS operating system environment, as by that time NPO "Plastik" had a YeS-1040 computer and YeS-7920 and YeS-7906 displays.

Conversion to a database management system (SUBD) constituted an intermediate stage in the process of realizing a dialogue between the user and the support portion of the AIPS. This stage makes sense, because analysis of existing SUBD identifies the following advantages thereof, compared to file-oriented application systems:

orientation toward the convenience of retrieval and prolonged storage of information, because an SUBD ensures nonredundancy and truthfulness of problem data, wherein new types of attributes are added, in most cases without the need to reorganize the entire database (BD);

orientation toward teleprocessing;

providing the capability of centralized control of collection and renewal of the AIPS information base.

The main complication in SUBD implementation is created by higher requirements, posed by the BD environment to data preservation and security (we shall later specifically examine the problem of data bank administration).

One of the principal problems that are being solved in the process of converting the AIPS to new conditions is selection of an SUBD. A working

procedure has been developed that makes it possible to choose an SUBD, depending on the requirements of the complex of problems to be solved, on specific operational features of the AIPS functional element and on the available equipment. The method for selecting an SUBD for the AIPS was based on a multicriterion approach that makes it possible to assess and compare various SUBD, based on the theory of making decisions on the set of features and specifications. Based on the this method, the INES system was chosen for AIPS-PLASTIK.

AIPS conversion to the new hardware and the new system and application PO called for developing procedures for converting the information base (IB) and the problem PO to new conditions.

The need to convert the system IB brought up the problem of developing a procedure that makes it possible, by using software, to convert the AIPS files, because reperforation of source data for loading in BD that meet the INES requirements is not feasible. The developed conversion procedure could be conditionally divided into two stages: forming linear files on an ML [magnetic tape], based on the AIPS fund and using the NSI-1-DOS, and loading this information into databases, using the INES.

The first stage is needed because of the difference in file descriptions in the DOS and OS operating systems and because YeS-5050 magnetic disks were replaced with YeS-5061 ones.

The second stage of the conversion was more complicated, as it included development of the AIPS BD structure, writing programs for describing the structure and source data preparation pattern and compiling assignments for loading the BD itself.

BD design was accomplished in two stages: the first one was distribution of source documents information over a BD and the second one was the design of the structure of specific BD.

Information distribution over a BD was performed, based on the character of the information source and, therefore, depending on its scope and frequency of renewal. In the process of developing the structure of each BD in the AIPS, one was taking into account the need for faster information retrieval, realization of grouping and information ordering, needed for solving functional and retrieval problems, and ensuring minimal redundancy of problem data.

Along with loading BD, conversion of problem PO was performed. Versions of PO conversion depended both on hardware for realization of problems and on specific features of programming thereof (Figure 1).

Conversion of problem PO, developed with the help of the NSI-1-DOS (retrieval queries and IB maintenance assignments), required repeated programming of these assignments, using the INES. However, it should be noted that this process was not labor consuming, because the INES system includes sufficiently developed means for automated programming of BD retrieval and maintenance problems.

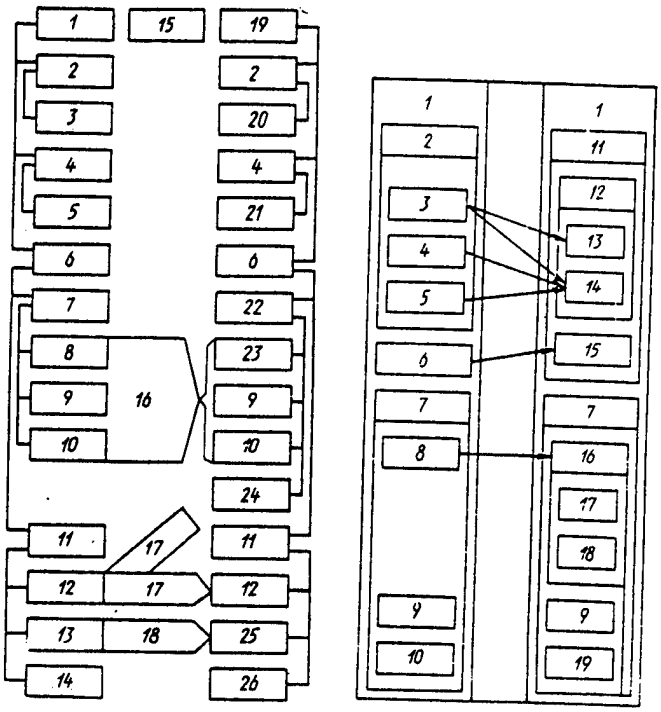

Figure 1. Specific Features of Software for Two Stages of Development of AIPS NPO "Plastik":
1 - structure of PO of the first stage of AIS development; 2 - system PO; 3 - DOS-ASVT; 4 - application PO; 5 - PPP NSI-1-DOS; 6 - problem PO; 7 - programs in the NSI-1-DOS language; 8 - linear file maintenance assignments; 9 - independent search queries; 10 - queries for preparing data for functional problems (FZ); 11 - programs and modules in problem-oriented languages; 12 - FZ programs with unknown values of search keys; 13 - FZ programs with known values of search keys; 14 - additional modules for NSI-1-DOS; 15 - specific features of conversion of problem PO; 16 - repeated programming of queries is required; 17 - repeated FZ programming is required; 18 - change in the format of attributes is required; 19 - structure of PO of the second AIS [automated information system] stage; 20 - OS $YeS_{v.m}$ 6.1; 21 - INES; 22 - programs in the INES language; 23 - BD maintenance assignments; 24 - modules of programs for solving FZ with unknown search keys; 25 - modules of programs for solving FZ with unknown search keys; 26 - additional modules for the INES

Figure 2. Structure of AIPS Supporting Element During First and Second Stages of System Development:
1 - structure of the AIPS supporting element at the first stage of AIPS development; 2 - Data Preparation Center; 3 - element of determining dynamic characteristics of the control object; 4 - element of primary information processing; 5 - element of analyzing results of automated processing; 6 - Scientific and Procedural Work Group; 7 - Information-Computer Center; 8 - element of automated

data processing software; 9 - element of automated calculations; 10 - element of tracking automated data processing; 11 - AIPS Development Control Department; 12 - application administration element; 13 - subject area analysis, construction and maintenance of BD conceptual configuration; 14 - interaction with the functional element, defining new applications, BD logic construction and maintenance; 15 - element of developing control models and procedures; 16 - system administration element; 17 - determining the structure for maintaining physical BD in proper working order and ensuring efficiency thereof; 18 - support of measures, aimed at BD preservation; 19 - BD software element

Specific features of converting functional problems depended on the character of the algorithm for solution thereof. The simplest, from the conversion standpoint, were those problems that were realized with the help of two modules: the module of a query in the NSI-1-DOS language for information search in data files and a program in problem languages (ASSEMBLER, PL/1 and FORTRAN). The conversion consisted of replacing a query with a search and in changing the format of numerical attributes in the problem program (in the NSI-1-DOS environment only a decimal packaged format for presentation of numerical data is possible, whereas the INES ssytem does not process this data format).

Converting problems, for which the required information in the BD is determined as they are being solved, turned out to be more complicated. Because of considerable differences in the language for information access by means of DOS YeS programming systems in the case of linear files and by means of INES (a lower level language for assessing the BD) in the BD environment, as well as the complexity of working with the latter, the procedure for converting this class of problems called for repeated reprogramming. In this case, the problems were either realized exclusively in the INES query language or consisted of modules, written both in the INES language and using the means of the ASSEMBLER language (for performing operations not provided for in the INES query language).

A specific feature of the AIPS supporting element in the SUBD environment is the need for performing administration, manifested in centralization of the database management.

The goal of administration in the AIPS is to manage design, development and operation of databases, as well as coordinate actions of various users (Figure 2). According to specific features of administration problems, there are two types of professionals in the Administrator Group in the case of the NPO "Plastik" AIPS: those in the first group are application-oriented and have good knowledge of applications (we shall call them application administrators); those in the second group are system specialists (we shall call them BD administrators).

Functions of application administration (see Figure 2) constitute one of the main tasks of the AIPS Development Control Department, and introduction of these functions is a distinctive feature of the second stage of the system development. These functions must be performed, because database organization

calls for solving problems of optimization and maintenance of BD conceptual configuration and logic structure.

The main objective of system administration, performed directly in the IVTs, is to ensure BD preservation, due to a large number of interrelations between data elements, as well as designing BD and ensuring efficiency of the physical organization thereof.

It took six programmers a year and a half to convert the AIPS elements in the SUBD environment. The efficiency and quality of system operation and maintenance improved considerably.

Operation of the AIPS-PLASTIK system has produced positive results, and the system has been recommended for application in other industries.

It is feasible to develop an interbranch system, based on the AIPS-PLASTIK, that would ensure that Minkhimprom carries out a unified technical policy in manufacturing plastic products. For machine and instrumentation building industries one can recommend development of data banks for plastic products, specific for a given industry, with information exchange with the AIPS-PLASTIK via automated communications channels.

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CLASSIFICATION SYSTEMS AND DOCUMENTS

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[Text] Table of Contents

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III. Management of Classification Systems and USD's

I. ASU Software; General Questions Relating to Classification, Coding and USD's

UDC 65.011.56:681.3

STATUS AND DEVELOPMENT PROSPECTS OF TELEPROCESSING SYSTEMS IN 'KIEV' ASU

[Article by V.N. Shafranov, Gorsistemotekhnika NPO [Scientific Production Association], Kiev]

[Text] The first phase of the Kiev ASU automated urban management system was put into service in 1985. The principal objective of developing the Kiev ASU was to improve the system and methods of controlling the socioeconomic development of the city based on the extensive application of mathematical economic methods and computer technology. This should ensure further improvement of the efficiency of public production and fuller satisfaction of the material and spiritual needs of the population [1].

The following are to be classified among the principal design features of the Kiev ASU:

The spatially distributed nature of automated information processes, which is associated with the territorial-administrative division of the city and the multisector nature of the problems to be solved.

The presence of a great number of functional subsystems and sets of problems to be solved at computing centers under departmental jurisdiction.

The functional specialization of certain computing centers and subdivisions.

The concentration of considerable amounts of information on industrial enterprises, housing and non-housing funds, engineering facilities, labor resources, and the city's population in citywide data banks, to which the majority of functional subsystems must be provided collective access (for the purpose of eliminating the repeated duplication of information in their local data bases).

The presence of a broad contingent of users---from data processing specialists to management personnel, traffic managers, etc.--and, in the future, the granting to the public of direct access to computing facilities and data banks (reference information systems, order taking systems, etc.).

Orientation toward the extensive introduction of control computer systems and automated workstations based on mini-, micro- and personal computers, which, by providing for the decentralized processing of information directly at the places of its origin and utilization, require coordination of their interaction, clustering of the results of processing at various management levels, and access to citywide data banks.

A number of automated systems (subsystems) for various functional purposes have been developed and introduced as part of the structure of the Kiev ASU at the present time. There are essential differences in design solutions, with respect to hardware, software, data base organization and management and the means of organizing these systems. The majority of systems have been implemented on the basis of YeS [Unified Series] computers. Data base management systems (SPEKTR, OKA, KVANT and BANK), telemonitors (KAMA, PPIMUS [as published], etc.), unique sets of programs and standard packages of application and utility programs can be used as part of the software. Some systems are oriented toward handling and processing considerable amounts of information (automated data banks for the housing fund, for labor resources, for people in line to receive housing accommodations, etc.), and others make possible the completion of calculating, optimization, and reference information tasks (automated systems for planning calculations, accounting, for the coordination and optimization of plans for holding breaks, etc.).

The automated systems of the Kiev ASU were designed as independent ones, oriented toward concrete functions and toward specific users having their own data bases and hardware. The principal, and in the majority of cases the only, mode of functioning is the batch mode. The processing and output of information to users are as a rule accomplished according to schedule and set forms of documents. Users' requests and input information are transferred by the submission of documents to the computing center, and, in individual cases, by the employment of telephone and telegraph equipment not

communicating with the computer through hardware or software. Batch processing is, if not optimal, at least satisfactory for the majority of functioning systems. Only a limited number of automated systems have been designed as teleprocessing systems with immediate servicing of the requests of numerous territorially remote users. The First Aid automated information dispatching system (AIDS), for example, comes under the heading of such systems. The First Aid ADIS has been implemented on an M-4000 computer expanded by means of 15 local and 12 remote terminals. Because of the efficient distribution of calls among teams, the choice of the optimal route to follow and monitoring of the work of response teams in real time, the introduction of the system's first phase will produce a saving of from 4 to 15 minutes for each call, which is equivalent to increasing the number of response teams by 18 to 20 [1].

YeS computers form the principal hardware base for teleprocessing systems. YeS-7920 displays and telegraph sets have become most widely used as terminals. Experience has been gained in implementing modes for the voice output of information by using telephone sets as terminals [2].

The following are hindering the more extensive introduction of teleprocessing systems in the Kiev ASU:

An inadequate supply of peripheral equipment and communication channels.

The lack of training of users in operating systems in teleprocessing modes.

Higher design and operating costs as compared with batch processing systems.

The development of the Kiev ASU should proceed in two directions:

The development of new independent teleprocessing systems, as well as improvement of the modes of functioning of existing systems.

The unification of independent automated systems on the basis of the formation of a computer information network (IVS).

Teleprocessing systems such as the ASU for the Main City Immediate Dispatching Station (the AIDS AST), the automated citizens' job placement system (the Job Placement AS), etc., are being designed and introduced within the framework of the first direction.

The AIDS AST is intended for the immediate recording of announcements of emergency situations and for organizing the work of the appropriate city services. The system is being implemented with a two-computer system (type 1420 SM [System of Small Computers] computers) expanded by means of 23 VTA 2000-15 terminals.

The Job Placement AS is intended for improving the up-to-dateness and reliability of data on the existence of job openings and vacancies at the city's enterprises, and for shortening the time for finding job placement alternatives for temporarily unemployed citizens. The system is being

implemented on the basis of YeS computers with user stations distributed at rayon job placement offices.

Design and experimental work on development of the hardware and software for the IVS [3, 4, 5], and on determining the structure of the distributed data base and the priorities for filling it [6, 7] is being done within the framework of the second direction.

Further development of the Kiev ASU will contribute to optimization of management of the integrated development of the city with fixed resources.

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RELATIONAL-NET APPROACH TO DESIGNING INFORMATION RETRIEVAL SYSTEM DATA BASES

[Article by O.V. Skorinko, RNIITs MVD USSR [Republic Scientific Research Information Center, Ministry of Internal Affairs, Ukrainian SSR]]

[Text] A central problem in the development of automated information processing systems is the designing of data bases, which calls for choosing the organization for data bases and providing for efficient management of them.

The data models chosen must meet the following requirements for information processing systems to be designed:

Flexibility and adaptability to changes in the information requirements of tasks or users.

Conformity of level of functioning, i.e., possibility of efficient implementation of the system user's requirements.

Independence of the data at the physical and logical levels, making it possible to be oriented toward the information content of the data without going into the details of their representation in the computer's memory.

The following three models of data have been set apart for the designing of data bases in accordance with the recommendation of the research panel on standardization in data base management systems, ANSI/X3/SPARC:

The external, representing the application of a specific view to a certain area of the real world.

The conceptual, oriented toward information aspects and adequate for objects and relationships of the real world.

The internal, related to the representation of information in the computer's memory.

A number of requirements for the description of a conceptual model of data have been formulated at the present time [1]. However, an analysis of existing data base management systems (SUBD's) shows that these requirements are not satisfied to the full extent when the language facilities available to these systems are used for describing the conceptual model. The following are the principal shortcomings:

Elements of the physical organization of data are specified, whereby the requirement of logical independence of the data is violated.

Satisfactory language facilities for reflecting the dynamics of the subject area are lacking.

It is not possible to describe fully the interrelationships of objects of the subject area.

Thus, it becomes necessary to introduce a logical model of data, which will be an intermediate model between the conceptual and internal model, and which will be described by the facilities of the data description language (YaOD) of the SUBD used [1].

Particular attention has been paid recently to the relational model of data suggested by (Kodd). This is a very simple structure, in accordance with the semantics of information and enabling the great independence of data [2]. This model takes into account all the properties and relationships of objects of the real world and ensures adequacy of the representation of the real world. Because of these qualities, the relational model is being used ever more often as the conceptual model of data bases.

In designing data bases based on the relational model, the problem consists in structurally transforming the requirements for data represented in the form of a composite model (as the result of conceptual designing) into relationships in a third normal form. These relationships can be obtained in the process of three-stage transformation of the data into two-dimensional (plane) tables having columns of a very simple structure. After relational algebra operations are applied to these relationships, they should provide the system user with ways of accessing the data.

Employment of the relational model at the stage of the conceptual design of a data base seems most efficient at the present time. However, the application of relational methods encounters a number of difficulties in development of logical and internal models of data. For example, complexities arise in the establishment of relationships between data of the "many to many" type. In addition, in a discussion of possibilities for efficient implementation, the net model receives higher marks, in that it is most suitable for supporting large data bases. An analysis of existing relational SUBD's, both domestic and foreign, shows that many aspects of the inefficiency of the relational model have not been eliminated in them, although in a number of SUBD's (System R, Query-by-Example) an attempt has been made at good physical implementation of relationships and efficient utilization of time and the computer's external storage. Also testifying in favor of the net model as a logical and internal model of data is the fact that at the present time SUBD's of the net type are the most highly developed and widely used because of the highly developed data description languages and data manipulation languages (YaMD's), the extensive set of utility functions and the powerful data teleprocessing facilities. The suggestions made by CODASYL--the association for data processing system languages--have exerted an enormous influence on the development of the net model of data and of SUBD's designed on its basis [3].

Thus, in association with the fact that at the present time there has been no efficient implementation of relational models of data, the most acceptable approach to designing complex and large data bases seems to be one in which a relational model of data is used at the conceptual level, and a net model at the logical and internal levels.

This relational-net approach makes it possible to design a data base which is simple to use and can be implemented efficiently. In addition, it

facilitates the great independence of data, flexibility and simplicity of introduction.

The relational-net approach was used successfully at the Republic Scientific Research Information Center (RNIITs) of the Ukrainian SSR Ministry of Internal Affairs for the purpose of designing the data base for the "Road Traffic" Automated Information Retrieval System (AIPS "DD") and its software. The main problem was the development of a relational-net interface between the conceptual and logical levels of the system. The SET-R package of application programs (SET-R PPP) was developed, which makes it possible to use relations for the purpose of representing the majority of data structures and to use relational algebra for operations on them. The SET net-type data base management system (SUBD), whose developers followed CODASYL's recommendations, was used as the basis.

The principal program components constituting the SET-R PPP are as follows:

Facilities for updating the data base, which implement the functions of loading, correcting and erasing information.

Facilities for retrieving information in the data base. These facilities are based on a high-level relational data manipulation language.

Facilities for the management of data base classification systems.

A relational-net interface for transforming user requests stated in specifications of the relational data manipulation language into commands of the corresponding SET data base management system language.

The SET SUBD itself.

The first three components of the SET-R PPP are not dependent on the SUBD used, which has a positive influence on changing from one version of the SUBD to another. Only the relational-net interface has to be changed in this case, as well as in the case of changing to a larger SUBD of the net type. In addition, the representation of data at the logical level is done without the user's participation, which considerably simplifies mastery and support of the system.

In implementation of the relational-net interface, a number of descriptor tables were developed, by means of which the interface is adjusted for the logical structure used for the data base. The adjustment process is performed in loading the nucleus of the package into the computer's working storage. Adjustment can be made both for the entire structure of the data base and for any part of it. This makes it possible to provide protection from unauthorized access to data in the system and to use the computer's working storage efficiently.

Four types of tables are used in the SET-R PPP: for the description of a relation; for the description of a document; for the description of operations; and for the projection of a relation.

The SET-R PPP's data manipulation language is an algebraic language and makes it possible to formulate requests in terms of relations with a limited set of relational algebra operations. Three basic relational algebra operations are used: direct union, projection and selection.

These operations are as a rule sufficient for writing requests in a data processing system class like information retrieval systems.

The data manipulation language becomes rather simple and flexible when relational algebra operations are used. A request to obtain information is divided into two parts: Which operations must be performed and on which relations are indicated in the first. And what criteria the relation formed must meet are indicated in the second.

The process of designing a data base when using the relational-net approach and the SET-R PPP calls for four steps:

Constructing external and conceptual models of the data base, whereby a relational model is to be used for the purpose of developing the latter.

Reducing relations between data to a third normal form.

Constructing logical and internal models, and generating a data base scheme and subscheme from the results of the preceding steps.

Constructing data description tables.

Thus, the relational-net approach suggested for the problem of designing data bases and the software described above (the SET-R PPP) make it possible to develop data processing systems in which:

The representation of data at the conceptual level is intelligible to a user not possessing special programming skills.

The employment of a logical level which is implementable without the participation of the system's user makes it possible to satisfy all the requirements for a conceptual model of data.

The dynamic independence of data is made possible, i.e., it is possible to reorganize the data base without modifying the software.

The data manipulation language permits maximum flexibility in the formation of unpredictable and incidental requests.

The duplication of information in the data base is totally eliminated.

Work is presently under way which will make it possible to implement additional relational algebra operations, which will make it possible to use the SET-R PPP in the development of a broader class of data processing systems.

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QUESTIONS RELATING TO STRUCTURIZATION OF OBJECT DATA BASE

[Article by A.P. Tarasyavichyus, NIIEP [Scientific Research Institute of Economics and Planning], Lithuanian SSR Gosplan]

[Text] Studies of foreign know-how in the designing of data bases give evidence of essential differences in both the approach itself and in the constitution and sequence of design stages, and, in addition, of the diversity of tools employed. The lack of a unified approach to structurization of the design process and of integrated validation in determining the structural components of a data base, and the difference of opinions regarding the process of describing the subject area to be investigated, demonstrate that the problem of a unified methodology for designing data bases as one principal component of an integrated information system has still not been solved.

The recommendations being proposed for the structurization of a data base are based on the model approach, whose essence consists in the systematic information representation of the subject area in the form of interrelated models. The designing of object data bases as a structural component of integrated information systems on the macroeconomic level is in mind. Here all the principal steps in designing data bases are covered, beginning with a detailed study of the subject area and ending with a description of the loading scheme and typical queries to the data base.

The structurization of an object data base for systems on the macroeconomic level is implemented with the completion of the following functions:

1) Definition of the subject area and analysis of the set of tasks.

2) Study of the information requirements of the subject area.

3) Determination of the structural components of the information technology model.

4) Construction of a chart of the information technology model of the subject area.

5) Specification of the data model and selection of the SUBD [data base management system] implementing it.

6) Construction of a chart of the logical structure of the data base.

7) Description of the process of loading the data base and of means of accessing it for various categories of users.

Each function corresponds to a specific stage in designing the data base, in the process of which the following sequence of models is constructed: an information model at the level of economic indicators (functions 1-2); an information technology model describing information objects and their attributes (3-4); and a model of the data base's logical structure, meeting the requirements of the management system implementing it (5-6).

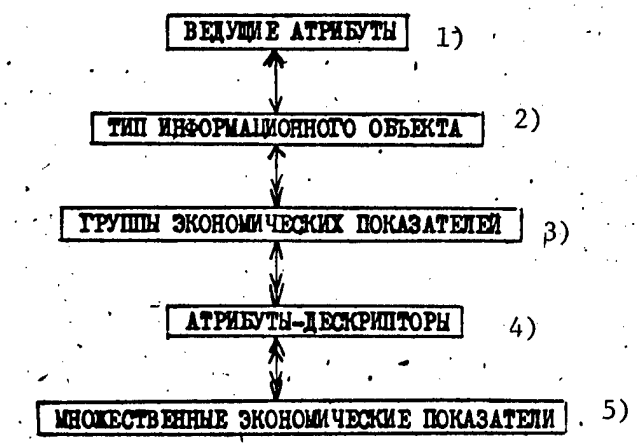
The process of designing a data base, as for any other complex system, must begin with a definition of the object to be designed, i.e., with setting the subject area apart from the problem environment under study. The problem environment usually encompasses a great number of subject areas whose integrated representation must be implemented in the information bank of the integrated information system for the problem environment in question. Isolation of the subject area for the purpose of designing an object data base requires a special predesign study for purposes of determining the feasibility of using the concept of a data base as the organization structure most appropriate for the subject of investigation.

An important step in the process of designing the logical structure of a data base is making a study of the information requirementss of the subject area. At this step the content makeup of the data base being designed should be specified to the economic-indicator level and the data base's structural components should be identified. Because of the fact that a data base for an individual subject area is designed as a component of an integrated information system, problems relating to the identification of structural components must be solved on the basis of a unified system for the classification and coding of technical and economic information.

The following approach can be used for the purpose of describing the process of studying information requirements. Strictly formulated problems, i.e., those for whose solution mathematical economic models have been developed, are isolated from the list of subject area problems. Based on an analysis of the exogenous parameters of models, a mask, unified for the entire subject area, is developed for describing information requirements, and the structure of this mask corresponds to the formal structure of an economic indicator. The information requirements of other tasks not having a strict formulation are also described in accordance with a mask. Thus, we obtain the absolute requirement, described in an informative information language, for the entire subject area. The real, interim and actual requirements of the subject area under study are established as the result of an analysis of the possibility of satisfying the information requirements described.

The second stage in designing a data base concludes with a description of information requirements, as a result of which the source material necessary for subsequent structurization of the data base is systematized in the form of an information model. An information model of the subject area can be constructed in any form: analytical-tabular, matrix, in the form of a flowchart, etc.

The process of constructing the logical structure of an object data base should begin with determination of the structural components of the information technology model, which is constructed according to the following scheme:



Key:

1. Leading attributes
2. Type of information object
3. Groups of economic indicators
4. Attribute-descriptors
5. Compound economic indicators

After completion of the description of structural components, a chart of the information technology model is constructed, which is a means of formalized representation of the subject area before it is referenced to the specific software of the implementing SUBD. The charts of information technology models of various subject areas can differ in the content of the model's structural components and in their number.

At the next stage in designing the data base--specification of the data model and selection of the SUBD to implement it--the process of information technology modeling concludes and direct designing of the data base's logical structure is proceeded to. This stage's complexity consists in the fact that it is necessary to ensure correlation of the features of the subject area being modeled with the specifics of the architecture and with the software of the SUBD used. The type of data model chosen also determines the flowchart of the data base's logical structure. A chart of the object data base's logical structure is constructed on the basis of the structural relationships of the

information technology model of the subject area and in accordance with the data model for the SUBD used.

The process of loading the data base and the means of accessing it are stipulated by the chart of the logical structure. The description of the process of loading the data base includes the structure of loading segments and a description of the chart for the reorganization of data.

A chart for the reorganization of input data is developed for the purpose of converting various structures of the input stream of information into forms of data loading segments. The input stream can contain data arriving in the form of unified documents on paper media and machine media--in records of various formats. In addition, some elements of loading segments can be formed from several input documents or various records. These facts make it necessary to construct a chart for reorganization of the input stream, in which the procedure for forming each type of loading segment assigned at the preceding stage must be reflected. Facilities for interactive access to the data base for various categories of users must be developed for the purpose of ensuring constant updating and the immediacy of responses to users' queries.

The procedure for structurization of an object data base, based on the systematic information representation of the subject area, can be used in designing data bases for various economic objectives as part of information systems on the macroeconomic level for management of the national economy.

II. Development and Introduction of Classification Systems and USD's

UDC 025.4:65.011.56:681.3:62-772:629.114

INTRODUCTION OF ALL-UNION CLASSIFICATION SYSTEM FOR TECHNICAL-AND-ECONOMIC AND SOCIAL INDICATORS (OKTESP) IN USSR STATE AGRICULTURAL INDUSTRY (GOSAGROPROM) AUTOMATED CONTROL SYSTEM FOR LOGISTICS TASKS

[Article by I.N. Solovyeva and S.N. Blokhina, VNIPIASU [All-Union Scientific Research and Planning Institute of Automated Control Systems], USSR Gosagroprom]

[Text] The introduction of the All-Union Classification System for Technical-and-Economic and Social Indicators (OKTESP) and of its branch part (the OKTESP-Selkhoztekhnika [Agricultural Equipment]) into the industrial-branch ASU is being done step by step--first for tasks of controlling the logistics of spare parts--along the following basic directions:

Unification by content of the forms of documents used in solving OASU [automated control system for a branch of industry] problems.

Efficient organization of computer data processing.

The unification by content of forms of documents is being done for the purpose of putting the makeup and structure of documents in order on the OKTESP's unified terminology basis, and it calls for unification of the names of the

technical-and-economic indicators (TEP's) appearing in the headings, columns and lines of the forms of documents used in solving functional problems.

The following have been the principal practical results of this work for tasks of supplying spare parts:

The names of indicators have been unified in more than 400 forms of documents used in solving 200 functional problems of the ASU-zapchast [automated control system for spare parts].

The inadequacy, redundancy (synonyms) and vagueness of information in the names of indicators have been eliminated, which has reduced by 30 percent the amount of information to be processed by computers.

A branch catalogue of TEP's (the KTEP) has been developed, containing an alphabetical listing of 250 unified names of indicators with an indication of the mask-position and OKTESP list codes corresponding to them, as well as of the forms of documents in which these indicators are used.

Much work has been done on unification by content for tasks of the logistics of spare parts for motor vehicles, tractors and agricultural machinery, including, for example, the distribution of spare parts according to requisitions, accounting and analysis of shipments, and determination of the supply of spare parts.

For purposes of efficient organization of data processing in the OASU, a procedure is being developed for using the indicator classification system. Implementation of the principal provisions of this procedure in the 12th Five-Year Plan period calls for the following:

A formalized description of indicator names and the development of an input information language for communication between programmer users and the data base (BD), including queries to the data base for retrieval and the accessing and grouping of stored data.

A description of the logical structure of the systemwide dictionary and reference fund of the industry's data base, making possible the correlated use of all dictionaries, manuals and technical-and-economic indicator classification systems in the industry.

The formalized description of indicators by means of the OKTESP is based on the facet formula for its structure, which defines the content, constitution and sequence of classification features for the name of a TEP. This formula is to be used in the OASU for the purpose of developing a unified system for the coding of indicators on the basis of all-Union (OKTESP) and branch (four-bit) codes.

The formalized description of the names of indicators by means of the OKTESP has served as the basis for the development of an input language for communication between users and the data base. This language belongs to the class of an OKTESP limited natural language (the OYeYa OKTESP).

A key concept of the OYeYa OKTESP is the notation structure of the identifier code for the numerical value of an indicator. By this structure is meant a fixed sequence of facets forming the full name of the indicator.

This notation structure is independent of the data description language for a specific SUBD [data base management system]. The OKTESP's limited natural language is formalized to such a degree that it makes it possible to translate descriptions of users' information requirements into the input language of the SUBD used, by means of a special data base generation program.

The facet terminological structure of an OKTESP indicator can also serve as the basis for efficient organization of the data base's systemwide dictionary and reference fund (OSBD) in an OASU, since it makes it possible to determine the required set of types of segments in the data base according to the facets used in the names of TEP's, these facets representing lists, dictionaries, manuals and technical-and-economic information classification systems.

For purposes of efficient organization of the OSBD, a chart has been developed for specification of the OSBD by the facilities of the OKTESP. This chart defines the structural-terminological and engineering relationships between individual components of the dictionary data base and facets of the indicator classification system.

The OSBD is to be formed and developed gradually as systemwide dictionaries, manuals and automated management systems for them, making it possible to solve sets of problems, are organized.

The following automated systems are functioning at the present time in the industry as part of the data base's systemwide dictionary and reference fund: for the centralized management of specification and reference information on spare parts (the ASTsVS NSI-zapchast [spare parts]), in which seven systemwide manuals are used; and the automated system for the management of all-Union classification systems for technical-and-economic information (the ASVOK TEI), which includes 20 classification systems.

The appropriateness of using the OKTESP in solving sets of OASU problems has been confirmed by an estimate of the anticipated saving for all directions of its use, amounting to 28,700 rubles, which is being achieved by reduction of the cost and amount of information to be processed and by the integration of data bases under development.

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FACILITIES WHICH EXPAND USER'S CAPABILITIES IN WORKING WITH INFORMATION FUND OF UNIFIED DOCUMENTS

[Article by N.K. Golubev, Main Computing Center, USSR Gosplan]

[Text] The second phase of the ASPR [Automated Control System for Planning Calculations] contains software which affords the user additional capabilities for working with data stored in the information fund of unified documents. These facilities provide the user direct access to a unified document. They

include a program for the immediate correction of information, facilities for a logic check within a document, and a set of form changing programs.

For the purpose of affording the user the capability of updating information, as part of the software making it possible to manage the information fund of unified documents a program has been developed at the GVTs [Main Computing Center] of the USSR Gosplan, which makes it possible to immediately correct documents in the interactive mode directly in the data bases of the information fund of unified documents.

The program operates under control of the OKA SUBD [data base management system] in the "data base - data transfer" mode and is in the form of a set of transactions which implement reading or the modification of data bases in the interactive mode from the screens of local or remote terminals.

The information is reviewed and corrected by the user himself--an economist who has received permission to access the data--in the modification or read mode for a specific unified form, group of forms or individual documents of a form.

Password protection is employed in the system for the purpose of guaranteeing confidentiality of the data.

The immediate correction of information can be performed simultaneously from several terminals and be implemented both with various forms and one and the same form, and even with one and the same document.

Information can be corrected during the entire time the control part of the OKA SUBD is functioning, including simultaneously with the execution of the mass loading of information by the SPD-OKA system [data preparation system]. The intradocument logic check program generator is a set of programs developed for the purpose of implementing a logic check of information prepared by the SPD-OKA system.

The specific nature of the preparation of data for the mass input of information, where the most characteristic features are the direct participation of a human being in data preparation, great amounts of input data, and strict rules for preparing them, necessitates various methods of checking the information to be entered.

Logical, mechanical and technical errors can be committed in the process of the preparation of information. There are a number of methods of detecting and eliminating mechanical and technical errors. The SPD-OKA system makes it possible to eliminate a large part of them. However, the problem of eliminating logical errors remains. The set of programs described was developed for the purpose of revealing errors of this type.

The user describes in a specially developed logic check language the logic check of documents that is needed by him. The program generator generates a data set with statement charts and writes the generated program, ready to execute, into the library in the load mode.

Then this program is executed at the user's request as a standard job of the operating system.

The following are the capabilities of the logic check program:

Documents to be subjected to a logic check can be prepared by the SPD-OKA and DOKUMENT systems or by the user's own program.

Only one logic check program can exist for each form to be checked.

It is possible to indicate the group, set, etc., of documents to be subjected to a logic check.

The user can specify that several documents be united into one according to specific heading characters, in order to check a united document.

Various types of checks can be implemented for a single document in the order indicated in the statements describing the logic check.

Further checking of the current document can be interrupted if errors were committed in any kind of check.

The user can indicate the conditions for the implementation of individual kinds of checks as a function of the result of the exection of previous kinds of checks.

Individual kinds of checks can be made on several groups or sets of documents.

The program executes the following kinds of checks:

A line check, i.e., a check of the relationships between elements of a document line in accordance with some arithmetic-logic formula for all the lines of a document of a unified form whose codes satisfy specific criteria.

A column check, whereby a check is made of the relationships between the elements of columns of the document for a specific set of columns of a document of a unified form.

The user can obtain the structure of the generated program in the form of a source text in PL/I and modify it at his own discretion.

The set of programs for changing forms is used to make various changes in documents found in the information fund's data bases, both with respect to the structure of the form itself and the document's contents.

The programs for changing forms make it possible for the user to alter and add to the composition of documents.

New documents--having a different content of specific bits--can be software-produced on the basis of active documents for a specific form. For example, by substituting heading codes, the user can produce documents having a new version, a different year or a different ministry. Specific columns of a

table can be given a specific content. Zeros can be put into them, for example.

A form can be given a new code.

On the basis of an existing form, the user can design a new one containing the old one's information in whole or part. Columns can be added to the form produced as the result of changing, the positions of the columns can be changed, and line codes can be used as the document's heading codes, and vice-versa.

By using specially produced recoding tables, the user can assign new values to individual indicators. In particular, this capability is employed for converting the codes for information found in the data bases of the fund of unified documents into the codes of all-Union classification systems for technical-and-economic information.

By the performance of successive recoding (several times), it is possible to produce a new unified form based on the elements of input unified forms.

The user is assigned a simple and convenient-to-use form changing language for the purpose of changing information. It serves the purpose of describing the concrete specifications for the changing program generator.

The following are described in the form changing language:

The input unified form to be changed.

The output (changed) unified form.

One or more unified forms used as recoding tables for individual fields of the input form.

The relationships between the input and output forms. It is indicated whether a new form will be created or whether changes will be made in documents of the original form (without changing parameter lists).

The possible conditions for the retrieval of codes in recoding tables.

The rules for the formation of output-form documents. Here, operators can be used which define the conditions under which statements will be executed, and expressions can be input which contain arithmetic and logic operations to be performed on bits to be changed (for example, the values of the indicators of a specific column can be multiplied by some other value, added to the value of an indicator from another column, be checked for meeting a certain condition, and the like).

Changing is implemented in several stages:

Control blocks and the changing program are generated on the basis of statements of the form changing language.

The source unified form is changed. The information obtained is written on magnetic tape.

The changed information is loaded into the unified document data base.

The program presents the user with a detailed diagnosis and recommendations in case of an incorrectly prepared assignment.

The software described in this article was submitted as part of the supporting engineering facilities for the second phase of the ASPR and was the basis for organization of the functioning and support of the information fund of unified documents. The preservation, reliability and up-to-dateness of information have been guaranteed by means of this software, the reliability of data has been improved, and the level of automation in the designing and processing of unified document forms has been raised. And this in turn is one of the necessary prerequisites for the successful solution of problems in the formation of drafts of State plans and in monitoring their fulfillment.

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UNIFICATION OF STATISTICAL REPORTING FORMS FOR CIVIL AVIATION AIRPLANE-HELICOPTER AND ENGINE INVENTORY

[Article by Yu.I. Batogov and V.A. Gurov, TsNII ASU GA [Central Scientific Research Institute of Automated Control Systems for Civil Aviation]]

[Text] Statistical reporting documents for the civil aviation airplane-and-helicopter and engine inventory (SVDP) are being unified because of the necessity of automating the tasks of keeping records of availability, movement, good working order and condition, as well as of developing new planning and control tasks by utilizing the experience gained in development of the automated system for controlling the withdrawal of gas-turbine-engine (GTD) aircraft for repairs.

The following reporting forms were used as of the start of work on the unification of reporting documentation for the SVDP in civil aviation:

Form No 1 ASU OR, containing 41 lines of particulars characterizing the condition of GTD aircraft, operating time and scheduled maintenance dates for the current year and planned for the next year, established service life, and actual flying hours according to type and months of the year.

Form No 2 IAS, containing 14 lines of particulars providing information on the serviceability of the airplane-and-helicopter fleet (SVP) in aircraft-days with the specification of downtime for non-serviceability.

Form No 3 IAS, containing seven lines of particulars containing information on the receipt, loss and writeoff of airplanes, helicopters and aircraft engines.

Form No 4 IAS, containing 13 lines of particulars characterizing the condition of the SVDP and service life remaining until the next overhaul or writeoff.

All these form were tabular, but the boxes did not make it possible to fill in the particulars with a typewriter. The information was not formalized for some particulars, and therefore they were filled in arbitrarily.

Information on both the airplane-and-helicopter and engine inventory was presented in form No 4 IAS. The report was cumbersome and inconvenient to work with, and the designations of SVP and aircraft engine types, as well as data on the state of service and location, were randomly presented in successive lines, which made machine processing impossible.

Forms No 1 ASU OR and No 4 IAS each contained 10 identical particulars. At the same time, Form No 2 IAS did not have indicators characterizing the extent of the utilization of serviceable airplanes and downtime in the serviceable but unused state.

All this made the automation of processing impossible, and therefore the decision was made to unify these documents.

For purposes of eliminating the duplication of information, organizing a unified method of filling forms in, making a visual check and inputing data, four unified reporting forms were established by agreement with the ASU [automated control system] client:

Form No 6 OASU, containing 17 particulars characterizing the condition of the entire airplane-and-helicopter fleet.

Form No 7 OASU, containing 15 particulars characterizing the condition of the entire engine inventory.

Form No 8 OASU, containing eight particulars presenting information on alteration of the composition of the SVDP.

Form No 20-GA, containing 20 particulars characterizing indicators of the serviceability and utilization of the SVP.

Each unified reporting form consists of three principal parts: the heading, information and validation.

The heading section contains the names and postal addresses of the receiver and sender of the document; document, sender and reporting period codes; number of lines in the document; and the document's name and submission deadlines. The column headings and a table for filling in the report line by line are found in the information section. The validation section contains lines for the official titles and signatures of the people submitting the report.

The boxes of the document's table are designed to allow for a typewriter's pitch and line spacing. This makes it possible to fill in the report with a typewriter. The documents are filled in by using systemwide classification systems (documents and enterprises submitting documents), as well as local classification systems (aircraft versions, SVPD movement events, location of

aircraft engines). All boxes containing indicators to be input into a computer are outlined in boldface.

The unified forms have been approved by the USSR TsSU [Central Statistical Administration].

The unification of reporting forms for the SVDP made it possible to eliminate the duplication of information, and to add extra indicators while realizing a total reduction in the number of particulars of from 75 to 60 for all documents, which made it possible to expand the range of functional tasks and to unify the process of transferring data to machine media.

On the basis of unified forms, it was possible to improve the method of gathering information and inputing it into a computer, and to implement the principles of gathering and inputing information on variations for the most labor-intensive reporting forms--No 6 OASU and No 7 OASU. These forms contain information which changes once every three or four years (the relatively permanent part) and which changes every quarter (the variable part). After completion of the processing of information on the computer for the last reporting quarter, information on the condition of the SVDP by each aviation enterprise is output directly from the computer for printing in tabular form in accordance with a structure totally consistent with documents on forms No 6 OASU and No 7 OASU. Here, the part of the line for variable information on each airplane (helicopter) or engine is divided into two sublines: The data submitted by the enterprise in the last report are printed on the top subline, and the bottom subline is intended for entering data for the current reporting quarter.

The printouts produced are distributed to each aviation enterprise ahead of time prior to the end of the current quarter. Only the data which underwent changes during the quarter are entered after the end of the quarter for each airplane (helicopter) or engine at aviation enterprises, and the filled-in documents are sent to the computing center for processing.

Data are input by using a YeS-7920 display, on whose screen appears an individual line of a document divided into particulars, and windows for entering the new value of a particular. Only the data which has changed during the reporting quarter are corrected on the display's screen.

The employment at operating enterprises of unified reporting forms and the data preparation scheme cited made it possible to reduce the labor intensiveness of filling in reports (by 50 to 60 percent) and of transferring data to machine media (by a factor of 2 to 2.5), and to lower the amount of errors in filling in forms (by a factor of three to four).

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DATA BASE ORGANIZATION AND MANAGEMENT OF AUTOMATED CONTROL SYSTEM FOR ENTERPRISES INTERACTING AT TRANSPORTATION CENTER

[Article by A.A. Nazarov, PKTB ASUZhT [Planning, Design and Technology Bureau for Automated Control System for Railway Transportation]]

[Text] The growing scale of industrial production, the mastery of new regions and raw material bases, and the extension of foreign trade ties have brought forth additional requirements for the improvement of mixed transportation utilizing various kinds of transport. Of great importance under these conditions is the level of organization of work at transportation centers, which, from the viewpoint of functional features, are characterized as complex combinations of dynamically interacting systems of various kinds of transport.

The organization of work at centers must ensure optimal planning, a high degree of management efficiency, reliability and completeness in monitoring the course of the transport process, and the smooth operation of all transport components.

Interrelations between various kinds of transportation are built on the basis of the interchange of information on the state of transport facilities and transportation using facilities. Items for information interchange include data concerning planned amounts of transportation for yearly, quarterly, monthly, 10-day and immediate time intervals, concerning the status of freight at places of its accumulation and forwarding to consignees, and concerning transportation and other documents enabling functioning of the production process and the compiling of reporting data. A characteristic feature is the great amount of information to be transferred and the high degree of dynamism at different periods of time.

The practical experience gained in interaction by organizations at the Leningrad, Riga, Lenskoosetrovsk and other transportation centers has demonstrated that the efficient solution of problems relating to the correct organization of the process of the operation of various kinds of transportation cannot be acomplished without the use of computer technology.

Experience gained in the development of automated control systems in transport ministries testifies to the fact that they have been conducted along departmental lines and have not taken into account questions relating to the interchange of information. A consequence of this approach has been the incompatibility of systems in key components, i.e., software and data base organization and management.

Questions relating to data base organization and management in the interaction of railway and sea forms of transporation are discussed below.

As in any system, data base organization and management at transportation centers includes document forms, classification systems for technical and economic information, and norm-setting and regulating documentation.

Document forms include primarily forms legally documenting the transport process (set of transportation document forms), and for planning documents, sector accounting and reporting documents, as well as documents of a non-formalized nature, i.e., used at specific transportation centers.

The contents of document forms determine the makeup of the information with which automated control systems functioning in transportation can be provided.

For example, the automated system for operating control of the transport process in railway transportation has telegram data--a full sheet on form DU-1--in its information base. This document contains data not only on the train as a whole, but also on each car in it, and the makeup of this information is sufficient for solving problems at a transportation center:

Particulars	Code Length
Start of message	2
Message code	2
Information transfer station code	4
Number of train	4
Station making up train	4
Number of set of cars	2
Station of destination	4
Set of cars checked from head (tail)	1
Date and time of departure of train from station	8
Nominal length	3
Gross weight	4
Holding code	1
Excess in size (top and side)	2
Livestock	1
Route	1
Chassis separator	2

Data on Each Car

Number in order	2
Number of car	8
Roller bearing mark	1
Weight of freight in tons	3
Station of car's destination	4
Freight code	5
Consignee	4
Route, nonworking stock	1
Holding code	1
Excess in size, livestock	1
Number of seals	1
Medium-tonnage containers	5
Large-tonnage containers	5
Tare of car	3
Note	6
Chassis separator	2

However, being unified, the documents take into account the requirements of only the kind of transport for which they have been developed. Therefore, sector classification systems are chiefly used for the purpose of coding information (up to 80 percent of the information), and only the All-Union Classification System for Loading and Unloading Points in Railway, River, Sea, Air and Motor Vehicle Transport (OKPPV), the All-Union Classification System for Countries of the World and Territories (OKSMT) and the System of Symbols

for Units of Measurement Used in Automated Control Systems (SOYeI) have been used out of all-Union classification systems.

The sector classification systems used in transport ASU's can be subdivided into two kinds: classification systems making it possible to solve problems in just one kind of transport, and classification systems designed for interchanging information. The employment of classification systems of the second kind requires the additional input of materials and labor, since it becomes necessary to change the forms of documents used in the framework of a given ASU and the information processing method used.

The principal sector classification systems used include classification systems for freight, clientele (consignors and consignees) and facilities for the consolidation of freight stations and packing.

A comparison of existing sector classification systems for freight demonstrates that they are nearly identical with respect to the makeup of items of classification, and in terms of code length they do not exceed five decimal places. Experience gained in working on the intercoordination of departmental ASU's at transportation centers made it possible to define the basic directions for their further development and demonstrated the feasibility of the development of a unified classification system for freight in transport ministries. This should be a classification system which takes into account the requirements of tasks in planning at all stages and levels, and of tasks in the preparation and evaluation of transportation documents, as well as in the operating control of shipments and the organization and planning of the work of equipment facilities in loading and unloading operations.

The problem of a single coding system for clientele is one of the most complex ones, since each kind of transportation uses its own classification system. In railway transportation this is a serial number system, which identifies consignors (consignees) within the scope of a single merchandise clearing office and does not make it possible to identify a using facility uniquely within the scope of the entire railway system. In river transport, the client does not have a code in transportation documents, but is identified by a five-digit serial code when information is transferred to a machine medium. Sea transport clientele are identified by a special code assigned in the sector section of the OKPPV.

Thus, individual kinds of transportation have their own approach to the identification of clientele. And a study of the question of the employment of the All-Union Classification System for Enterprises and Organizations (OKPO) produced a negative result, since classification criteria necessary for the organization of production processes are lacking in it, and not all facilities which are transportation clients are included, in association with the fact that they are not facilities which are legally independent.

The changeover to the employment of the OKPO in transport ministries is being delayed for these reasons.

Information on facilities for consolidating and packing it is important for the characterization of freight. Work done by transport ministries on solving the problem of the quarterly planning by means of a computer of shipments of national-economic freight demonstrated that it is not feasible to use information from the OKP [All-Union Classification System for Products] for identifying these characteristics, because of the long code length. This has resulted in great additional cost not only in the preparation of information, but also in the processing of documents. A classification system developed by international transport agencies was recommended for use as the result of experimental testing. The facet method of classification is used in it, and the code length does not exceed two decimal places for each particular of a document.

The improvement of the data base organization and management of ASU's for enterprises interacting at a transportation center is aimed at improvement of the management of these enterprises and at raising the operating level of all kinds of transportation.

III. Management of Classification Systems and USD's

UDC 65.011.56:025.4:622

AUTOMATED MANAGEMENT OF ALL-UNION CLASSIFICATION SYSTEM FOR INDUSTRIAL AND AGRICULTURAL PRODUCTS (OKP) IN COAL INDUSTRY

[Article by G.A. Anufriyeva, VNIIUugol [All-Union Scientific Research Institute of Management of the Coal Industry]]

[Text] The All-Union Classification System for Industrial and Agricultural Products (OKP) is used in solving functional problems of the Sector Automated Control System in the Coal Industry (OASUugol).

In the process of the automated management and improvement of the OKP, its files have been subjected to changes, which has been associated with the appearance of new items for classification, the cancellation of obsolete items, changes in the names of groupings, the allocation of reserve capacity, and the transfer of existing K-OKP groupings to other ministries.

The OKP is amended by means of the Centralized Data Base of the Sector System of Classification and Coding (ITsB OSKK), developed within the framework of the Sector Automated System for Management of Classification Systems in the USSR Ministry of the Coal Industry (OASVKugol).

The organization of automated management of the OKP is governed by the "Statute on Management and Improvement of the OKP and CEMA OKP in the USSR Minugleprom [Ministry of the Coal Industry]" and provides for the following: the gathering and analysis of suggestions regarding changes; the coding of new and previously produced products not included in classes, subclasses, groups and subgroups of the OKP which have been assigned to the USSR Minugleprom; the development and management of standards; reference information services for users; replies to one-time queries from enterprises and organizations.

Automated management of the OKP required the improvement of input document forms in use in the industry.

Specifications have been developed for the processing of documents, governing the procedure for filling in forms for changes in OKP information written on machine media.

Input document forms are totally consistent with the input information preparation layout. Source information is prepared from input documents without the copying of information, which increases its reliability and effectiveness.

Suggestions regarding changes arriving at the Head Service for Management of Classification Systems (GSVK) are entered in the journal for recording suggestions regarding changes. Then the information is subject to an examination by experts for its consistency with a given class, subclass, group and subgroup; for the presence of the obligatory particulars for the heading and tabular sections of the document, of instructions, a position code, and for the correctness of the code's entry (modulo-2 check); and for validation of the change. An entry for a specific OKP data base (BD) contains a heading, which includes: the date of the update, the number of the list of suggestions regarding changes, and the date of its approval. These code table particulars are circled with a thick line and are punched.

Input information arrives, as it accumulates, from the GSVK at the USSR Minugleprom GVTs [Main Computing Center] for implementation of the process of management of the OKP.

The process concludes with a listing of the results of the updating of information in the form of input document forms with prefixes indicated on them, which makes it possible to make an analysis of the results of updating and an unambiguous check of the contents and state of the data base.

The OASVKugol exchanges magnetic tapes (ML's) with the GNITsVOK [not further identified]. Updated information on the OKP, changes and additions arrive from the GNITsVOK at the USSR Minugleprom GVTs on undated magnetic tape in ASTsVK [not further identified] format. The information is processed by means of a program for converting information from a file written in ASTsVK format to a line file having records of fixed length. The loading of information into the TsIB OSKK for future use is completed on the basis of the updating line file formed.

The OASVKugol provides OKP information services to users for information contained in the data base both on paper and machine media. Information on machine media will be used in two versions.

In the first case the loading of information is to be implemented by restructurization of the data base into the users' functional data base. Changes are circulated by means of the OASVKugol software, by accessing corrected copies from the data base to a sequential data set having records of fixed length in its structure, and at intervals stipulated by users.

In the second case, the OASVKugol's software and data base organization and management make it possible to use information from the data base directly in solving functional problems.

The OASVKugol provides for the selective distribution of information on changes in the OKP in accordance with users' interests. Information on changes is printed out in the form of a summary of changes and additions on an alphanumeric printer once a quarter. The summaries are printed and sent to users who do not have computers.

Summaries on paper are not sent when working with users in the automated mode, but a brief synopsis is given of the information contained in a specific summary. This makes it possible to access retrospective information from the data base as needed.

When large amounts of information are coded, executive services for the management of classification systems (ISVK's) working in the automated mode present the USSR Minugleprom GVTs with a list of suggestions regarding changes on magnetic tape prepared in the format called for by the OASVKugol's software, and a protocol of changes in which the results of a semantic and logical check of the information prepared at the GSVK are reflected.

The GSVK analyzes and, when necessary, corrects the input information in conjunction with the USSR Minugleprom GVTs. Approved changes are sent to the USSR Minugleprom GVTs for the purpose of updating the data base. The updated data base is copied onto magnetic tape and is sent together with the correction protocol.

The USSR Minugleprom GVTs copies the data base in its current state on users' magnetic tape at specific time intervals (twice a year).

In addition to periodically notifying users regarding changes in the OKP, the OASVKugol provides reference services to users in the batch processing and interactive modes. When reference services are offered in the interactive mode, the data base is accessed via a system of local and remote terminals in the query-reply mode.

The organization of automated management of the OKP in the coal industry is aimed at keeping up-to-date the data base organization and management of various levels of ASU's.

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8831
CSO: 1863/239

GROWTH OF TURKMENISTAN'S INFORMATION INDUSTRY HIGHLIGHTED

[Editorial Report] Ashkhabad SOVET TURKMENISTANY in Turkmen 22 November 1986 carries on page 3 an 1,100-word article by the economic journalist Kh. Nyyazov on the growth of the information industry in the TSSR. "The computerized central scientific-research Institute of Economics started operations as a TSSR Gosplan center in October 1971. The institute has 25 departments employing 270 workers; 27 workers are science candidates. Institute departments operate in Ashkhabad, Chardzhou and Tashauz Oblasts. At present the institute is equipped with YeS technology." Among its achievements are the designing of the plan for the establishment and development of the West Turkmenistan Territorial-Production Complex and basic studies in the development of labor resources. The author complains, however, that other automated management systems in the republic are confined to "narrow departmental duties" which reduce their effectiveness.

/13046
CSO: 1863/244-E

ESTAFETA LOCAL AREA NETWORK SHOWN ON TV

[Unnamed city] STV-2 in Russian 1530 GMT 12 Jan 87

[Text] [Announcer] The Ivanovo 'Informatika' scientific-production association has developed the 'Estafeta' local area network.

[Reporter, over Video of computer room with terminals and printers, box about 500 mm x 300 mm x 100 mm marked in Cyrillic 'SLS Estafeta' - for stantsiya lokalnoy seti [local area network station]; control panel marked in Cyrillic ES 1080.02] Attempts to connect computers of various types, terminals and printers, into a unified system of information exchange have been undertaken before in our country. But the means for this communication were, as a rule, costly, unreliable, and were put out in extremely limited quantities. And now the people in Ivanovo have solved the problem. The local network unit is compact, costs relatively little, and connects with subscribers with conventional telephone cable. This network can connect up to 125 units of various computer devices, and this means that it can be used not only to set up integrated automatic control systems and flexible production systems, but also so-called 'office' systems for connecting automated workstations in offices. And this direction is particularly full of prospects at the moment, after the start of series production of personal computers in the country.

[A.P. Pozhigaylo - captioned as General Director of 'Informatika' scientific-production association - interviewed in office] The requirement for this equipment is enormous, and already now [inaudible] by autonomous means and by our own forces we are building a small works. However, to resolve the problem, to supply these units as integral units - we have to supply the unit and the software - we need a serious production base, and, on this issue, we are relying on the help of the Ministry of Instrument-Making and construction organizations in Ivanovo oblast. Our engineers are at present already developing a unit which is three times as productive as this one.

[Reporter] This is already the third generation, yes?

[Pozhigaylo] This is already the third generation of unit, and we are setting ourselves the task of making in a year-and-a-half to two years' time a unit which is ten times as fast as the existing one, and all the subsequent modifications will be made totally on a home-produced components base.

/13046
CSO: 1863/244-E

UDC 518.878

OPTIMIZATION OF DESCRIPTOR INFORMATION RETRIEVAL SYSTEMS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. SERIYA: VYCHISLITELNAYA MATEMATIKA I KIBERNETIKA in Russian No 1, 1987 (manuscript received 24 Dec 85) pp 51-55

[Article by A.M. Ivani and A.N. Sotnikov]

[Abstract] A study is made of the problem of selecting the optimal dimensions of descriptor zones for library information retrieval systems with hierarchical-zone organization of the data set. An approximate equation is presented for determination of the optimal dimension, plus a table which compares the results of application of the equation with the precise value of the dimension. The table indicates that the equation yields a precise value in all cases studied. References: 3 Russian.

6508/13046
CSO: 1863/251

UDC 519.682

ONE METHOD OF CONSTRUCTING AN LR(1) ANALYZER

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. SERIYA: VYCHISLITELNAYA MATEMATIKA I KIBERNETIKA in Russian No 1, 1987 (manuscript received 26 May 85) pp 55-61

[Article by V.V. Ignatov]

[Abstract] An algorithm is formulated for construction of an LR(1) analyzer in three stages. The initial grammar is used to construct a set of subgrammars, for each of which an LR(1) analyzer is constructed. The analyzers obtained are combined and edited to produce an analyzer for the language defined by the initial grammar. During the second stage, an SLR(1) or LALR(1) analyzer may be constructed by applying the method to a subgrammar. The volume of the analyzer constructed by this method will be no greater than that of a Knuth analyzer. References 4: 3 Russian, 1 Western.

6508/13046
CSO: 1863/251

UDC 51:621.391

USE OF PROOF COMPUTATIONS ON COMPUTERS TO STUDY PROPERTIES OF LINEAR MAPPINGS IN FINITE-DIMENSIONAL SPACES

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 23 Feb 83) pp 106-112

[Article by P.I. Balk]

[Abstract] Machine approaches and the experience of proof of significant statements concerning the properties of mappings, primarily linear mappings, in finite dimensional spaces are presented. The advantages of systems of analytic computation, capable of restoring initial functions, over manual analytic methods are greatest in problems requiring the solution of multiple integrals using a known but complex hierarchical structure. The specifics of software and measures taken to assure reliability of results considering memory limitations in computers are discussed. Figures 2; references: 8 Russian.

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CSO: 1863/198

UDC 519.85

QUALITATIVE STUDY OF TRAJECTORY PROBLEMS

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 6 Apr 84) pp 82-89, 105

[Article by V.K. Leontev and E.N. Gordeyev]

[Abstract] A study is made of a number of qualitative properties of trajectory optimization problems. The stability, finite valuation and possibility of tabulation are studied. An approach is suggested to estimation of the quality of heuristic algorithms for the solution of trajectory problesm. References 25: 22 Russian, 3 Western.

6508/13046
CSO: 1863/198

UDC 518.9

FIRST DIRECT METHOD OF L.S. PONTRYAGIN AND SOME EFFECTIVE PURSUIT METHODS

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 14 Dec 84) pp 75-81

[Article by A.A. Chikriy, M.V. Pittsyk and N.B. Shishkina]

[Abstract] Various pursuit methods are studied, based on ideas similar to the direct method of L.S. Pontryagin. Methods are discussed which arise in the solution of problems of group pursuit, and differences are established between the times of ending of the game corresponding to each approach. A functional analog of the first direct method of L.S. Pontryagin is found, and sufficient conditions are established for coincidence and difference in pursuit times in this method with the time of effective pursuit methods. Figures 3; references: 16 Russian.

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CSO: 1863/198

UDC 519.8

CONTROLLABILITY IN MULTIVALUED DISCRETE PROCESSES

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 21 Mar 85) pp 62-65

[Article by Vu Ngok Fat]

[Abstract] Based on the ideas of investigation of controllability in multivalued processes, this article produces necessary and sufficient conditions for controllability of convex multivalued processes. In contrast to previous results, the conditions are expressed directly through the reference function of the graph of the multivalued mapping. Then an approximate convex process is constructed for the problem of controllability of nonconvex processes, and a theorem on controllability of nonconvex processes is proven, from which conditions can be obtained for local controllability for nonlinear, nonsmooth systems with limitations on controls. References 8: 5 Russian, 3 Western.

6508/13046
CSO: 1863/198

UDC 007:510.25

FORMAL TECHNOLOGY AND UNIVERSAL SYSTEMS. II.

Kiev KIBERNETIKA in Russian No 5, Sep-Oct 86 (manuscript received 25 Jan 83) pp 28-31

[Article by S.M. Krylov]

[Abstract] The first part of this article studied some important structures and properties of formal technological systems, with primary attention given to operations and processes of synthesis of new elements or structures. The present article studies the properties and structures of formal technological systems with operations of synthesis and analysis, i.e., more completely reflecting the set of operations in actual technological systems. The concept of the formal technological system allows significant expansion of the class of objects studied using the theory of algorithms and recursive functions. All of the formal technological systems analyzed in the article generate countable sets of objects, indicating "equal power" of the corresponding universal technological systems, allowing representation of one technology in terms of another, as in the technology of processing of symbolic information. There are very attractive models of universal automatically acting synthesizers capable of solving problems of research or applied problems. Some such models allow simple technical interpretation and can thus serve as basic theoretical models for flexible automatic production facilities and systems. References 2: 1 Russian, 1 Western.

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UDC 519.86

MATHEMATICAL MODELING: PROCESSES IN COMPLEX ECONOMIC AND ECOLOGICAL SYSTEMS

Moscow MATEMATICHESKOYE MODELIROVANIYE: PROTSESSY V SLOZHNYKH EKONOMICHESKIKH I EKOLOGICHESKIKH SISTEMAKH in Russian 1986 (signed to press 20 Jan 86) pp 1-6, 290-296

[Annotation, foreword by N. N. Moiseyev and A. A. Petrov, table of contents, and abstracts of articles from book "Mathematical Modeling: Processes in Complex Economic and Ecological Systems," edited by A. A. Samarskiy, N. N. Moiseyev, and A. A. Petrov, USSR Academy of Sciences, Department of Informatics, Computer Science, and Automation, Izdatelstvo "Nauka," 2,500 copies, 296 pages]

[Text] ANNOTATION

This collection presents one of the contemporary directions in mathematical modeling, which opens up the possibility of introducing new information technology (with the use of computers) into various areas of human activity. Mathematical models of economic systems, including of the feedbacks operating in them, which determine the type of economy, as well as models of ecological systems, are examined. General problems of mathematical modeling and systems analysis are discussed.

This book is intended for specialists engaged in applied mathematics and in the application of computers for the investigation of complex systems.

FOREWORD

Problems concerning the structure and study of models of complex phenomena represent a traditional direction in the activity of the Computer Center of the USSR Academy of Sciences. Models of various physical processes, which were described by equations of the hydrodynamic type, were the object of research in the 1950's. However, the research front expanded gradually and the study of ecological processes and processes occurring in the social sphere--in the economy, history, conditions of conflicts among groups of people, and so forth--began to occupy an important place in our work. The transition to such tasks deprived researchers of the traditional basis for a mathematical description created in mathematical physics and required the development of new approaches. Furthermore, the models of processes occurring in the social environment are not closed and, in addition to the principles of

construction of the models themselves, the researcher faces the problem of developing methods of closing them.

The construction of big mathematical models opens up the possibility of transforming a computer into an experimental unit. However, a successful performance of a computer experiment also requires a special organization of the interactive (dialogue) mode. Often this requires not only the development of complex auxiliary software, but also of an entire system of auxiliary models.

A special term "simulation systems," which unifies the system of initial modelssimulating the studied reality and the entire necessary service, making it possible to repeatedly utilize models for the performance of a series of mathematical experiments, originated at the Computer Center of the USSR Academy of Sciences in the middle of the 1960's.

This collection contains studies by associates at the Computer Center of the USSR Academy of Sciences performed in connection with problems concerning the construction of simulation systems. Three sections of this collection describe three research directions. The first section is devoted to mathematical models of economic systems. An approach to the study of economics differing from that traditionally accepted in mathematical economics has been formed in our country in recent years. When modeling the economic system, we concentrate principal attention on a mathematical description of economic mechanisms of regulation. Economic mechanisms are feedbacks operating in the economic system. It is precisely the specific nature of feedbacks that distinguishes one economic system from another, because feedbacks embody production relations formed in a given economy.

Such an approach is nothing new. It represents only the transfer of some of the basic ideas of Marxist political economy to the area of applied mathematical research. The results obtained convince us of the fruitfulness of this approach. Within the framework of a single theory it was possible to describe many characteristic features concerning the development of the market economy. However, this is only the beginning. The main task--following the basic principles of political economy--is to describe the process of production concentration and production relations characteristic of the centrally planned socialist method of production.

Mathematical models of economic systems, which reflect economic mechanisms of regulation in an obvious form, open up new possibilities for the application of computers for solving problems of planning economic development and designing mechanisms ensuring the fulfillment of envisaged plans. However, before such models are developed definitively, it will be necessary to solve a number of fundamentally new problems concerning the application of computers for the organization of mathematical simulation experiments. It is a matter of the following: In the area of physical applications the computing experiment on a computer is set up for the purpose of refining the description of physical processes. As a rule, the system of equations describing the studied processes is known quite well. Utilizing the data of physical and computing experiments, it is necessary to refine some descriptions and to refine parameters in certain descriptions. These are very complex tasks.

However, in the area of social applications the mathematical simulation experiment is qualitatively more complex.

Usually, even basic equations describing social processes are still unknown. It is impossible to set up a pure purposeful social and economic experiment. Mathematical simulation experimentation with models on computers remains the only means of checking fundamental (or else, initial elementary) hypotheses concerning the structure of social relations and interactions of social processes. Experience shows that such hypotheses can be formulated as some variation principles. It is comparatively rarely possible to analytically derive from the initial variation principle the consequences of the qualitative nature concerning the properties of studied relations or interactions. The task of learning to derive qualitative consequences from simulation experiments on computers arises. This is a new direction in simulation modeling. It is urgent not only in the economic area of applications, but also in areas of biological and ecological applications.

The collection's second section pertains to the modeling of ecological systems. In connection with this it should be noted that our research is of a pronounced interdisciplinary systems nature. This circumstance has left an imprint on the content of the second section. Problems of closing systems of equations describing the course of different processes in the ecosystem and their interaction are studied. To learn to evaluate anthropogenic effects on ecosystems is the strategic direction in research. In turn this opens up new possibilities for computer application in economic planning problems. It appears possible to evaluate remote consequences of adopted economic decisions.

The modeling of ecosystems serves the attainment of another important goal. So-called global problems have arisen in all their magnitude during recent decades. Mankind's industrial might has increased to such an extent that industrial activity threatens to shift the balance of global processes in the biosphere. The task of evaluating the effect of economic growth on a planet scale on the state of the biosphere has become urgent. In order to accomplish this task, it is necessary to construct a supersystem of mathematical models. It includes models of atmosphere and ocean circulation, models of carbon and nitrogen cycles in the biosphere, models of effect of economic activity on these processes, models of manifestation of these effects in various ecosystems, and so forth. It is quite clear that the mathematical simulation experiment on a computer is the only tool of solving this interdisciplinary problem. In this area of applications it is important to develop a new methodology of the simulation experiment.

The collection's third section touches upon general problems of mathematical systems modeling. These problems once again arise in connection with the systems approach to the mathematical modeling of objects with a complex structure. Such objects are described by models with an appropriate complex structure. To investigate such models "head-on" on a computer is not at all a simple, if not a hopeless, matter. As a rule, however, models of real objects have a natural hierarchical structure. Therefore, they allow decomposition and this facilitates the task considerably. However, in order to decompose the system naturally, it is necessary to study its structure and to clarify

the characteristics of the hierarchy. In connection with this new mathematical problems, which are not trivial, arise. Some methods of solving these problems are presented in the collection's third section. In the same section the problem of modeling and analyzing complex systems by means of computers is also examined from another point of view. The simulation system in itself is a complex system. The designing of such a system and its commissioning and operation are related to the designing and commissioning of a new technological complex. Specialists in different branches of science participate in this matter. Therefore, problems concerning the organization of the development, introduction, and operation of the simulation system deserve a special discussion.

We hope that problems concerning the mathematical modeling of complex systems touched upon in the offered collection will be of interest to specialists working in new areas of applications of mathematics and developing a new information technology based on modern computer hardware.

The editors express their profound gratitude to N. K. Burova, who took an active part in the preparation of this collection.

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SYNOPSES OF ARTICLES

UDC 519.86

PROBLEMS OF MATHEMATICAL DESCRIPTION OF ECONOMIC PROCESSES AND ECONOMIC SYSTEMS ANALYSIS

[Synopsis of article by Petrov, A. A. pp 7-18]

A survey of the state of research directed toward the development of methods of a mathematical description of interacting economic processes and methods of deriving macrocorrelations forming the mathematical model of a developing economic system is given. Special attention is paid to the need to adequately reflect the basic ideas of political economy in a mathematical description. 28 bibliographic entries.

UDC 519.86

EFFECT OF STATE EXPENDITURES ON THE NATURE OF DEVELOPMENT OF THE MARKET ECONOMY

[Synopsis of article by Krutov, A. P. and Romanko, A. V. pp 19-45]

The mathematical model of an economic system of the classical market type is proposed and investigated. Special attention is paid to the financial sector of the economy and the functioning of the bank system, methods of financing state expenditures, and tax policy are described in a clear form. The existence of stable balanced growth regimes is demonstrated. Research results and numerical experiments have shown that the model correctly reflects the main qualitative characteristics of mechanisms regulating the capitalist economy. An evaluation is made of the model's parameters on the basis of statistical data in the United States in 1979-1984. As a result of the model's investigation, conditions, under which the growth of nonproductive state expenditures reflects the economic interests of basic social groups of capitalist society, have been found. 16 illustrations; 13 bibliographic entries.

UDC 519.86

MODEL OF THE PROCESS OF CHANGE IN THE CAPACITY AND PRODUCTION FUNCTION OF AN ECONOMIC SECTOR

[Synopsis of article by Olenev, N. N., Petrov, A. A., and Pospelov, I. G. pp 46-59]

A mathematical description of the process of aging of an economic sector's production capacities is proposed. It is suggested that in the process of a production capacity's aging a reduction in the quantity of output produced in a unit of time is not accompanied by a corresponding reduction in the number of work places. Owing to this, the aging of a capacity causes a decrease in labor productivity in it. The sector's current technological structure is described by the distribution of its production capacities according to the magnitude of labor intensiveness per unit of output. A new category of the sector's production functions is described. The production function is obtained by integrating the distribution of capacities according to labor intensiveness, which in the examined case is complicated by the deformation of distribution owing to the change in the technological characteristics of an individual capacity (labor intensiveness) depending on the service life of this capacity. 4 illustrations; 12 bibliographic entries.

UDC 519.86

PRODUCTION FUNCTION OF A CAPITAL INTENSIVE ECONOMIC SECTOR

[Synopsis of article by Krishtal, V. V. pp 60-76]

A description of the production function of an economic sector in the economic system of the classical market type is offered. Such a description takes into consideration the effect of payments for fixed capital on output. The model of change in capacities and technological characteristics of production units is examined. A differential equation of the change in the capacity density is

derived. It is shown that the sector's output depends on the amount of the used capital. A specific example of constructing the microdescription of the dynamics of production capacities is presented.
17 bibliographic entries.

UDC 519.86

PROBLEM OF UNITIZING ECONOMIC GROWTH MODELS

[Synopsis of article by Shananin, A. A. pp 77-105]

One- and two-sector models of growth of the market-type economy with fully loaded capacities are investigated by methods of the qualitative theory of ordinary differential equations. An example of a two-sector model, which after averaging according to rapid market fluctuations is unitized into a one-sector model, is constructed. 5 illustrations; 7 bibliographic entries.

UDC 519.86

UNITIZED DESCRIPTION OF A GROUP OF SECTORS BY MEANS OF THE FUNCTION OF REDUCING VARIOUS FINAL PRODUCTS TO A UNIFORM PRODUCT

[Synopsis of article by Shananin, A. A. pp 106-147]

A group of interconnected sectors producing various final products is examined. A procedure of unitizing production functions of sectors' profit by means of the function of reducing various products to a uniform product is constructed. Properties of unitized production functions--profit, demand, and supply functions--are investigated. 16 bibliographic entries.

UDC 519.86

VARIATION PRINCIPLE IN DESCRIPTION OF ECONOMIC BEHAVIOR

[Synopsis of article by Pospelov, I. G. pp 148-162]

The variation principle is offered for describing the behavior of an economic agent in the market-type economic system. Every economic agent seeks to minimize the probability of its destruction. A class of models, for which it is possible to formulate this variation principle in a strict mathematical manner, is described. It is shown that in the examined class of models, when conditions natural from the economic point of view are fulfilled, the variation principle requires that the economic agent maximize the average discounted profit. 9 bibliographic entries.

UDC 519.86

MODEL OF INVESTMENT POLICY OF FIRMS IN THE MARKET-TYPE ECONOMIC SYSTEM

[Synopsis of article by Olenev, N. N. and Pospelov, I. G. pp 163-173]

A mathematical description of the economic activity of an industrial firm is offered. The process of emergence and liquidation of firms is examined. It is assumed that a new firm is organized with borrowed funds and is liquidated if it sells all its fixed capital. The conditions of a firm's emergence and bankruptcy are written out. This microdescription of activity is included in

a closed one-sector model of the market-type economy. Preliminary results of this model's investigation are presented. 4 illustrations; 7 bibliographic entries.

UDC 930.2+312

CRITICAL POPULATION OF PRIMITIVE COMMUNITIES: MODEL OF GROUP SELECTION

[Synopsis of article by Buzin, A. Yu. pp 174-196]

The change in the size of a community (population) is described either by the Markov process of "birth and death," or the diffusion process. Ultimately, every community either dies (if its population reaches zero), or is divided into two communities with a population of J/2 (if its population reaches the "threshold of division" J). The totality of communities with the same threshold of division is called a group. When a community is divided, offspring either remain without fail in the group of the parent community (model without mutations), or with some probability pass into any other group (model with mutations). The dynamics of distribution of communities throughout groups is investigated. At the same time, the natural definition of the "optimal threshold of division" J* arises. The functional, which reaches the maximum when J=J*, is indicated. Evaluations of this functional, which simplify its investigation and have a natural interpretation, are presented. 2 illustrations; 2 tables; 23 bibliographic entries.

2. MATHEMATICAL MODELING OF ECOLOGICAL SYSTEMS

UDC 517.911+502.5/8

APPLIED PROBLEMS OF MATHEMATICAL ECOLOGY

[Synopsis of article by Svirezhev, Yu. M. and Logofet, D. O. pp 197-206]

Some problems of theoretical and practical ecology are discussed: "chaos" in the dynamics of isolated populations with nonoverlapping generations; the predator's ability to regulate the population of its victim; stable existence of trophic chains of a varying length depending on the speed of arrival of an external resource; ecological-energy analysis of aggregated agroecosystems. The ecological nature of modeled objects determines the nontraditional nature of formulations of forecasting and optimization problems. Giving up the forecast or optimal selection of precise dynamic trajectories, which under the conditions of uncertainty of the medium does not have much sense, is their common feature. The search for stable states or structures capable of withstanding disturbances and surviving in a changing world serves as an alternative. 3 illustrations; 15 bibliographic entries.

UDC 57.02.001.57:574.4

MODELING OF TUNDRA POPULATIONS AND COMMUNITIES

[Synopsis of article by Baybikov, Ye. V., Belotelov, N. V., Zavyalova, S. V., Obridko, I. V., Orlov, V. A., Sarancha, D. A., Shelepova, O. V., and Khilyayeva, L. M. pp 207-219]

For an analysis of mechanisms forming fluctuations in the populations of tundra animals, the following models are examined: 1) of the trophic "vegetation-lemmings-polar foxes" chain;" 2) of the population of lemmings with due regard for the age structure; 3) of the "vegetation-lemmings" community with due regard for their spatial distribution. All models are recorded in the form of differential equations and are realized on a computer. As a result of simulation experiments, three- and four-year fluctuations in the population characteristic for tundra communities are obtained for all models. Approximate methods of a qualitative analysis of examined models are proposed. 10 illustrations; 15 bibliographic entries.

UDC 532.5+519.2

PROBLEMS OF CLOSING THE SYSTEM OF HYDROLOGICAL MODELS OF THE RIVER BASIN

[Synopsis of article by Koryavov, P. P. pp 220-239]

Problems of closing the system of hydrological models describing the processes of moisture movement in the ground atmospheric layer, river bed flows, surface runoff, and movement of underground water in nonsaturated and saturated zones and in pressure horizons are discussed. An examination of models for the nonsaturated zone and the ground atmospheric layer leads to the need to also include plant growth models in the system, for the closing of which, along with moisture distribution processes, processes of heat and nutrient distribution in the nonsaturated zone and processes of air mass displacement, heat distribution, and change in illumination in the ground atmospheric layer should be described.

As a result of the unification of the indicated models, a very complex system is obtained, making it possible to perform an analysis of possible anthropogenic effects on the region's water regime, development of vegetation, and change in local climatic characteristics.
3 illustrations; 27 bibliographic entries.

UDC 519.86

UTILIZATION OF THE GEOMETRIC METHOD FOR ANALYSIS OF ECOLOGO-ECONOMIC SYSTEMS

[Synopsis of article by Bushenkov, V. A., Kamenev, G. K., Lotov, A. V., and Chernykh, O. L. pp 240-251]

The results of application of the geometric method of analyzing controlled systems for an investigation of economic objects with due regard for ecological indicators are described. The geometric method consists of a numerical construction and further investigation of the set of all attainable values of the indicator system. In this work the method is used for studying two regional and two global ecologo-economic models.
7 illustrations; 19 bibliographic entries.

UDC 519.6

INVESTIGATION OF DISPERSION PROPERTIES OF A TWO-LEVEL MODEL OF GENERAL ATMOSPHERIC CIRCULATION

[Synopsis of article by Khvorikov, N. A. pp 252-264]

In a linear approximation dispersion relations are obtained for equations of general atmospheric circulation continuous in the vertical coordinate, as well as for two-layer equations utilized in the Mints-Arakava model. The domain of stability of two-layer equations, as well as of the boundary of applicability of utilized approximations, is determined. Evaluations for phase velocities of baroclinic and barotropic waves are obtained.
5 illustrations; 3 bibliographic entries.

3. SOME GENERAL PROBLEMS OF MATHEMATICAL SYSTEMS MODELING

UDC 519.86

APPROXIMATE DECOMPOSITION OF MODELS OF CONTROLLED PROCESSES

[Synopsis of article by Pavlovskiy, Yu. N. pp 265-280]

Basic concepts and facts concerning the theory of accurate and approximate decomposition of controlled dynamic systems are described. A hypothesis on the structure of control of complex systems is formulated.

30 bibliographic entries.

UDC 519.86

SYSTEMS OF MODELING COMPLEX PROCESSES

[Synopsis of article by Pavlovskiy, Yu. N. and Savin, G. I. pp 281-289]

Problems connected with the development and introduction of interactive systems of modeling complex processes designed for utilization as tools in the specific practice of planning, management, and designing are described.
4 bibliographic entries.

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CONFERENCE: USE OF MICROPROCESSORS FOR ASU TP

Yerevan KOMMUNIST in Russian 25 Nov 86 p 2

[Article by R. Gevorkyan, Director, Scientific and Technical Branch of the "Avtomatika" Scientific Research Institute, Kirovakan, entitled "All-Union Conference," under the "On the Routes of Scientific Technical Progress" rubric]

[Text] The present organization levels of industrial production impose new, rather severe demands on the technical and economic characteristics (reliability, operational, and meteorological) of computer facilities and on the ASU (automated control systems) based on them.

Topics related to increasing the effectiveness of applying microprocessor technology in various areas of the national economy were the subjects of discussions at the All-Union Conference "Theory and practice of the development and implementation of ASU TP [automated control systems (for) technological processes] based on microprocessor technology" in Kirovakan.

The conference was organized by the USSR Ministry of Instrument Making, Automation Equipment, and Control Systems and the Armenian SSR Academy of Sciences.

Specialists concerned with the development and implementation of ASU TP based on microprocessor technology participated in the conference.

The purpose was to disseminate the accumulated industrial experiences with respect to the development and implementation of automated control systems based on microprocessor technology.

Representatives of more than 50 organizations and enterprises concerned with development and implementation of ASU TP based on microprocessor technology in the machine-building industry, chemical industry, nonferrous metallurgy, the gas industry, and in mineral fertilizer production met at Kirovakan.

It was noted at the conference that the use of microprocessor technology created a new means of industrial automation, which has been given the designation of programmed microcontroller. However, in spite of the significant effort and costs related to the development and implementation of ASU TP, their practical effectiveness is far lower than the projected indicators.

They as yet do not assure quality and reliability, because of overall system shortcomings, the lack of reliably functioning hardware components, and the lack of satisfactory levels of work on the applicable software.

The conference called the attention of designers to the problems of further increasing the reliability and range of microprocessor technology equipment, of increasing the effectiveness of its application, and of improving its operating characteristics.

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STANDARDIZATION AND QUALITY MANAGEMENT IN VARIOUS REGIONS OF THE COUNTRY

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 87 pp 39-41

[Article by Ye.T. Larina under the "At VDNKh SSSR" [the USSR Exhibition of Achievements of National Economy] rubric]

[Text] The CPSU Program states: "The maximum possible improvement of the technical level and quality of products is becoming the central objective of our economic policy and all practical actions. Soviet-made products must embody the latest achievements of scientific thinking, meet the highest technical, economical, aesthetic and other consumer requirements and be competitive in the world markets".

Subject-oriented exhibitions at the VDNKh SSSR play an important role among other measures, aimed at paying more attention to the drive for improving quality of domestic products. The "Standardization and Quality Management in Various Regions of the Country" exhibition presents scientific methodological principles, goals and objectives of territorial systems for managing product quality (TS UKP) and economic and social development of various regions, as well as ways for improvement thereof.

At the exhibition that took place in the fall of 1986 in the "Standards" pavilion, enterprises of Novgorod, Tula and Rovno oblasts and the city of Poti, Georgian SSR, shared their experiences in developing and implementing these systems. The opening portion of the exhibition presented organizational and methodological principles of TS UKP. Regional expositions presented structures of territorial systems, functions of managing and operating agencies thereof and efficiency of their functioning. TS UKP and integrated special-purpose programs of improving the technical level and quality of products (the "Kachestvo" ["Quality"] programs), developed within the TS UKP framework, must solve an important problem of the current stage of production development: to overcome dissociation of enterprises of different industries, which will make it possible to more successfully and rationally combine the industry and territorial principle of planning and management.

In TS UKP, the management of product quality is performed by Party, Soviet and business organizations.

The overall management of work on creating, functioning of and improving TS UKP is conducted by a territorial council (commission) on quality. It coordinates operation of all system management agencies, approves TS UKP directive documents, examines and evaluates results of enterprises activities on quality improvement, organizes interaction between production and scientific collectives.

The exposition demonstrated the experience of the city of Moscow system for managing product quality (MGS UKP), the first of its kind in the country. Implementation of the system made it possible to improve utilization of the city scientific and industrial potential for improving product quality under the motto: "Quality guarantee, from design to product". Within the MGS UKP framework, an integrated special-purpose "Kachestvo" program was developed and approved. Its implementation will make it possible to bring parameters of the most important products, manufactured by capital's industry, up to the highest world level during the 12th Five-Year Plan.

This section of the exposition reveals specific features of the Leningrad TS UKP, such as efficient use of the product quality certification mechanism and proceeding to certification of technological processes, the use of programmed special-purpose methods for planning quality improvement and improving metrological support in all branches of the city and oblast economy.

The section also exhibited the first republican quality control system [RS UKP], the Latvian RS UKP. Among its distinguishing features are wide application of programmed special-purpose planning and management methods and development of the unified system for product control and testing.

The section presented data on principles formation of regional "Kachestvo" programs is based on. Thus, the Moscow special-purpose "Kachestvo" program, created within the MS UKP framework, was developed, based on suggestions from enterprises, and coordinated with and approved by corresponding industrial Ministries. The program consists of three parts. The first part includes specific targets for improving parameters of the most important products in accordance with the priority directions of technological development, such as computer controlled machine tools, automated production lines and robotic complexes, microcomputers etc.

The second part of the program includes plan targets for improving parameters of all products that would be manufactured in the capital during the 12th Five-Year Plan. The third part includes a complex of measures, required for meeting all targets of the special-purpose program, such as updating of enterprises, commissioning of new production areas, installation of new and modernizatio of the existing equipment and introduction of new progressive technological processes.

Meeting the "Kachestvo" program targets will make it possible to increase the share of products, carrying the State Quality Mark, to 70% of all products subject to certification, 85% for machine building industry products.

A target of the Leningrad complex special-purpose program is to get the highest quality category certification for 520 types of products in the

machine and instrumentation building industries, introduce 220 new highly efficient products and discontinue production of over 150 types of morally obsolete products.

By 1990, the share of products, carrying the State Quality mark, in the total volume of products subject to certification will reach 70%.

In regional sections of the exposition, the visitors were able to get an idea of specific features of TS UKP, implemented in the Novgorod, Tula and Rovno oblasts and in the city of Poti, Georgian SSR.

In the Novgorod oblast, about 40% of industrial products subject to certification have been awarded the State Quality Mark.

The city of Novgorod system for managing product quality (NGS UKP) is headed by the Novgorod CPSU gorkom [the city Party committee]. The system covers 36 industrial enterprises and 8 scientific-research and planning and design organizations.

Functioning of the system is regulated by 15 city standards. Since the system was implemented, the share of products subject to certification has increased to 46%, and at some associations and enterprises this index exceeds 80%. Recently, TS UKP have been impelmented in five more industrial towns and rayons of the oblast. The exposition reflected the Novgorod oblast territorial and industrial program of economic intensification, "Effectivnost [Efficiency]-90". The program includes measures for achieving targets, set by the 27th CPSU Congress, for social and economic development of the region, based on acceleration of the scientific and technical progress.

The program consists of eight integrated special-purpose programs, including "Kachestvo". The exposition presented the latter in greater detail. Its implementation makes it possible to more than double the output of products in the highest quality category. The exposition presented experience of those enterprises that had succeeded in achieving good results in managing product quality.

Thus, for instance, the Novgorod NPO [scientific and production association] "Kompleks" is one of the largest enterprises that were among the first in Novgorod to introduce such progressive developments as robotics, powder metallurgy, automated design systems (SAPR), to create GPS [flexible manufacturing system] modules etc. NPO "Kompleks" exhibited its best products, such as industrial robots and a prototype of the ALIM-2 industrial line for mass production of twisted magnetic circuits, made of electrical steel ribbon.

Collectives of production associations "Elkon" and "Avtospetsoborudovaniye" and PTO [Production-technological Organization] "Planeta" and a number of light industry enterprises that achieved a high rate of production growth during the 11th Five-Year Plan also exhibited their achievements and products.

The Tula oblast has accumulated vast experience in economic development, improvement of the regional business mechanism and implementation of

integrated systems for managing quality of operations and economic and social development. A special section of the exposition was devoted to this subject. In 1985, about 70% of the oblast enterprises implemented the KS UKP [integrated system for managing product quality], with savings of over 30 million R during the 11th Five-Year Plan.

Considerable work has been done on getting employees involved in production management and converting their initiative into a permanent and active management factor, as well as on revealing production reserves. This has resulted in considerably improved quality of products, manufactured in the region. Thus, the share of products in the highest quality category in the total volume of products subject to certification increased from 35.8% (1980) to 57.8% (1985); 48 enterprises of the oblast manufacture products, carrying the State Quality Mark.

The exhibition also presented a regional "Kachestvo" program that covers industrial enterprises and planning and design organizations of the city of Tula and 12 rayons of the Tula oblast. The program provides for increased output of products, certified in the highest quality category; development and introduction, by specified dates, of new types of consumer products that are in high demand; timely replacement and discontinuing production of morally obsolete products and products with no demand for them.

The oblast "Kachestvo" program was formed, based on the "Kachestvo" programs of the oblast enterprises and rayons. A program at each level includes a summary plan for improving the technical level and quality of specific types of products, targets for improving main technical level and quality indices of the most important types of products and planned measures for ensuring that the targets are met.

The main section of the Tula exposition is devoted to the "Kachestvo" program. The Tulaites' experience in its development and implementation is recommended for widespread dissemination.

Realization of the broad complex of objectives, specified in the program, will improve reliability and durability of products with Tula mark. It is intended that by 1990 at least 75% of products subject to certification be manufactured in the highest quality category and that products that are of utmost importance to the national economy be only manufactured with the State Quality Mark. Savings due to implementation of the program will be equal to 2.5 million R.

All measures, directed at implementation of the program, are headed by the Coordination Council (the Quality Section) of the CPSU obkom [oblast party committee].

This section also dealt with scientists' participation in solving problems of improving product quality.

NPO "Tulachermet", one of the largest enterprises in the country that employ powder metallurgy methods, presented samples of its products. Technical and economic indices of products, manufactured by the association, exceed those of

the best foreign analogs. During the 12th Five-Year Plan the oblast enterprises will do a great job on improving technological preparation of production on the basis of the YeSTPP [unified system of technological preparation of production]. The exhibit demonstrated the main directions in improving this work at Aleksin plant "Tyazhpromarmatura". The oblast integrated "Kachestvo" program involves wide application of computer technology and modern economico-mathematical methods for production management and control of production processes. Some enterprises presented working ASU [automated control systems] and ASUTP [automated systems for control of technological processes]. Enterprises of the Central rayon of the city served as an example. They ship their products to 31 countries. During the 12th Five-Year Plan the share of products, carrying the State Quality Mark, will reach 80.2%.

Tula enterprises reported on their experience: due to 60-95% product unification level they considerably expanded the assortment of new types of products and reduced new product introduction time. They also presented information on prospects for upgrading and technical retooling.

The exhibit presented various consumer products. Meeting targets, included in the integrated "Kachestvo" program, will considerably facilitate acceleration of the economic and social development of the Tula oblast.

The Rovno oblast territorial system for managing product quality and social and economic development is an efficient form of improving the business management mechanism. The visitors were able learn a lot of interesting and useful things in this section. Implementation of the system made it possible to achieve good results. The share of products in the highest quality category was equal to 20.4% of the total production volume and 58.5% of the output of products subject to certification.

The Rovno oblast system for managing quality and social development makes it possible to more comprehensively combine industrial and territorial interests in the region in order to improve quality of products and work. Its distinguishing features are wide dissemination of methods for public territorial management of productive and nonproductive spheres. Experimental territorial standards constitute the normative basis for the territorial management system.

Over 60% of enterprises in the city of Rovno have implemented integrated systems for managing product quality and efficient utilization of resources (KC UKP i EIR). As a result, the output of products, carrying the State Quality Mark, has increased significantly.

Experimental territorial (city) standards regulate relations between enterprises, located within the region, ensure stability and reliability of mutual relations and eliminate the negative effect of random factors on production rhythm, thus improving production efficiency.

During the period of mastering the Rovno TS UKP (1980-1985), due to introduction of new equipment, implementation of new manufacturing processes and automation and mechanization of labor-consuming operations the amount of

manual labor was reduced and savings of 24.4 million R were realized.
As the city system standards require, since the system has become operational, quality of manufactured products has been improving, and the share of products, carrying the State Quality Mark, in the total volume of products subject to certification has reached 72%. The exposition emphasizes the main principle of the system: unification of activities of labor collectives of enterprises, belonging to different industries, aimed at reaching a common goal. The system covers all branches of the city economy. Such programs as "Energokompleks" [Energy Complex], "Agrokompleks" [Agricultural Complex], "Materialoyomkost" [Material Consumption], "Kachestvo" etc. have been developed and operate as a part of the system.

During the 11th Five-Year Plan the oblast enterprises and organizations implemented around 50 assignments of All-Union and republican and over 1000 assignments of regional scientific and technical programs. Total savings exceeded 10 million R.

The exhibit exposition presented the integrated special-purpose program "Kachestvo" for the 12th Five-year Plan. According to this program, it is planned to increase by 1990 the share of industrial products in the highest quality category to 78% of the total output of products subject to certification. The "Kachestvo" program is an important component of the plan for social and economic development of the region.

The exposition also demostrated the ways of solving the problem of improving product quality at individual enterprises and organizations in the Rovno oblast.

The city of Poti, Georgian SSR, exposition presented experimental optimization of territorial management of economy. The principal objective of the experiment is to ensure planned and proportionate development of the city economic complex and a rational combination of the territorial and industrial management principles. The first direction of the experiment is improvement of planning; the second is strengthening the role of economic methods in territorial management and more efficient application of economic incentives and leverage, i.e. cost accounting, profits and bonuses. The third direction is improvement of the organizational structure of management of the city economy.

The exposition presented results of the experiment: during the 11th Five-Year Plan production volume increased by 141.9%, whereas productivity increased by 140.7%. Over 100 million R worth of goods was manufactured in excess of the Five-Year Plan targets. The output of products in the highest quality category increased by a factor of 2.4. The exposition demonstrated achievements of the Poti Sea Cargo Port, where advanced forms of freight traffic have been implemented. The exposition also presented products of the "Potielektroapparat" plant and various products, manufactured by enterprises in the light and food industries.

It is planned to accomplish a lot during the 12th Five-Year Plan, as the industrial production output is scheduled to increase by 133%. The output of products in the highest quality category will increase by a factor of 1.7.

The visitors were exposed to the interesting and helpful experience of labor collectives of the above regions that actively search for ways to improve organization of production and product quality level.

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12770
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THE COMPUTER HAS COME TO SCHOOL

Alma-Ata RUSSKIY YAZYK I LITERATURA V KAZAKHSKOY SHKOLE in Russian No 7, Jul 86 pp 3-8

[Unsigned article]

[Text] A year has passed since our schools made the transition to general computer education. In this quite new and difficult matter the teacher has been aided by specialists, scientists and high school teachers. And now we have overcome the timidity of the first steps in the necessary psychological rethinking required in adopting the computer as a modern instrument for the worker. All pedagogues, including philologists and Russian language teachers in Kazakh schools, have come to realize that the economy of the nation is everyone's business. In addition to mathematicians and physicists, philologists have been summoned to work on the problem set forth in establishing this school reform. In their work, they must take into account the fact that familiarizing the student with productive labor is closely connected with the student's economic education and the formation of his economic thought process. The fact is, students sitting at their desks in school are faced with the task of fulfilling the great designs of the party and continuing the work of their fathers, so that our motherland will become even mightier. For this, they must learn to lead our great economy as a modern economy and life itself require. We must all recall the words of M.S. Gorbachev: "The Soviet Union was and remains the embodiment of age-old human hope. And it must be an example of the highest level of organization and effectiveness of its economy."

The stern word ECONOMY on the pages of government documents, scientific works and textbooks continually enters into our daily life, suggesting the art of leading the economy, the skill to foresee, deep penetration into the essence of the phenomena and laws of social life, the skill to compose plans for the near future and for many years ahead, and the skill to see what is important in the present. That is why our schools must turn their gaze toward today's production. Each student must work at real machine stations in real shops, in the field and on the farm. The modern worker, in addition to practical skills, needs the ability to make creative decisions, have personal ideas as to how to better perform the tasks he is charged with, with the economic good of the state in mind. The essence of the great work which is revolving around the leadership of the party in industry and in agriculture demands this; work which is being bolstered by the reform of our schools. Such is the

social order of the day. It is necessary to be psychologically prepared to work in a new manner, to be capable of quickly mastering the newest machines and technological processes.

In order to teach the student of literature and his colleagues brought up in the learning environment of the school lesson the characteristics of working, and other things that may prove useful in adult life, such as persistence, clearness of purpose, and the ability to follow a project to the end, the teacher must himself know the fundamentals of modern production.

In fact, a Russian language teacher in a Kazakh school was at the side of the instructor who with his tenth-grade students (in Russian!) inaugurated the use of the textbook "The Fundamentals of Informatics and Computer Technology," helping them to master the rudiments of computer literacy of the 20th century, as if it were the book of ABC's.

As the experience of the first year of study has shown, a new discipline has its own specific characteristics. But at the same time, this experience enjoys a wide range of interdisciplinary connections. In studying the fundamentals of informatics, the student develops a so-called algorithmic thought process, the ability to consciously plan his activities and construct a model of the events which he encounters. This subject positively affects the learning of other disciplines, both in the natural sciences and in the realm of the humanities, and certainly affects the quality of the student's education. Russian language teachers in Kazakh schools who earlier had no need to come into direct contact with computer technology must recognize that today, computer literacy is becoming a necessary component of general education for them as well. And now the terms COMPUTERIZATION, SECOND LITERACY, and COMPULSORY EDUCATION IN ELECTRONICS are a part of their lessons. This is not simply paying homage to fashion, but a demanding requirement of life itself. But how could it be otherwise, if the school teacher is allotted the decisive role in educating computer operators? It is, namely, he who must continually produce cadres who are computer and information literate. And the teacher who helps the student to read textbooks better in the Russian language is allotted a large role in helping him to understand the basic assemblies of an intelligent machine, compose simple algorithms, effectively use a new learning device, carry out an elemental dialogue with it, and send this or that information to the display screen.

And, of course, the student of literature understands that we speak not of a simple competition between the computing speed of an arithmometer and a computer, but of a revolutionary, philosophical reconception of our traditional way of thinking, of the means of multiplying the intellectual potential of our generations in the epoch of scientific-technical progress. The student of literature will take step after step along a path toward familiarity with the new terminology and concepts of informatics. And this will be a familiarity by means of a great plan! The student of literature will explain that the computer, liberating man from routine operations, from the yoke of study and memorization of a huge quantity of standard algorithms, allows man to model his world, to create new, complex models of the world, to predict the results of our collective efforts towards perfecting it, and that, as a result, man's

thinking power is multiplied manyfold, supported not by his experience alone, but by that of entire scientific collectives, which are creating universal algorithms. It is necessary that the opportunity become clear to the student that he can rise to a qualitatively new level in his intellectual and creative work if he is to master the conceptual apparatus of informatics and is to be able to grasp the set of problems that stands before him. And it is also necessary that the student learn to be creative, just as he learns reading and writing. Curiosity, logical thinking, the strive for originality in scientific research analysis and experimentation do not come to a person naturally.

Students now not only encounter new subjects in their studies, but in their Russian classes they encounter new terms that impart very terse and precise understandings of a new realm of activity. These terms render a hidden effect on the way the subjects studied by upperclassmen are interpreted. It is possible that this will have an influence on the future specialist. The Russian language is a means for the realization of knowledge, and it leaves its specific imprint on knowledge. Students, with the help of the Russian language, will need to be sensitive to this terminology boom, an explosion into the age of scientific-technical work. Terms will resound around the students, and they will enter into their speech. In fact, the terms are heard on television and radio, and they leap off the pages of newspapers and creative literary works. And if the Russist is able to master an algorithmic language and become computer literate, that means that school reform is proceeding as planned.

Quite recently, students of literature often admitted that "mechanization" of education frightened them: Wouldn't it bring utilitarianism to the school? Wouldn't the young people's delicate perception of the word in the general sense, and of the word in the pedagogical sense be destroyed? But common sense won out: The approach to language from the standpoint of an "engineered" thought process and of formal logic is not right. Enriching oneself with new terminology, "natural language," "multifaceted" and "variational" does not remind one of a difficult code at all. The modern Russian language caters to all forms of activity and human interrelation, and all the resources necessary, including such expressive and popular terms as BEHAVIOR ALGORITHM, PROGRESS INFLATION, MONEY-GRUBBING VIRS and EPICENTER OF EVENTS are available in it.

Today in our schools we now speak of using the computer as an aid to individuality of the teacher, to increase his qualifications and teaching ability. Life itself requires that the system of supplying scientific-pedagogical information to the teacher be changed and perfected, particularly in the realm of the theory and methodology of communist education, making it accessible, timely, and mass-oriented. And to do this without the application of computer technology is impossible. In Moscow, at the site of the main computer center of the "Hydroproject" Institute an experiment is underway, in which the realm of the educational interaction between school and family has been taken as the information base.

The developed version of this, under the conditional name "Parent-Teacher," aids the class instructor, with a minimal expense of effort and time, to obtain

data characteristics of a specific family, and pedagogical information necessary to organize interaction with the parents of the students. Information material has been gathered into the form of advice for the teacher and a list of recommended literature. Encoded and transferred to perforated cards, this material is recorded on magnetic tape and stored in the computer center, where the teacher may refer to it with his inquiry card. The text information he obtains corresponds to the everyday situation he is interested in, and it recommends appropriate specific pedagogical actions, forms and methods for dealing with children, and even reminds the teacher of the rules of professional tact, warning against typical mistakes. All this is very important for the teacher: and the deciding word does still remain with the teacher, not with the computer.

The experiment is convincing in that it is possible to create a database system in all disciplines in the scientific realm of education, for each school year, and to store in an information bank not only methodological advice, but also various types of didactic material (for elective courses, study groups, and extracurricular groups). It will be good when regional computer centers can manage the specific types of computers in pedagogical institutes and universities. And the rural teacher will be able to send in his punched cards by mail.

Many students of literature in our nation and our republic were inspired to believe in the computer by learning to program without it, a subject which many took an interest in 20 years ago. The essence of this lies in arranging textbook information not as a stream of information, but in measured doses and steps, by which the student can raise himself to a level where he is able to draw conclusions independently. Teaching programming without the aid of the computer is inexpensive, and the effect is striking. Intelligent decisions take place in an instant. And the fact that there is a hand touching the computer is a guarantee that the written word will be literate. But the computer only accelerates the course of this cognitive work. Education in programming conceals within itself the opportunity for the teacher and student to learn to interact with the computer. Before meeting the computer, they have the knowledge to operate it and have learned an algorithmic language. The path to the computer is truly not only of passive expectation. Instead, it opens the door to pedagogical creativity.

In schools in Hungary, for example, the computer has come to be used for the study of Russian language, in mastering occurrences which simply must be memorized: word stress, for example, or the presence of a fleeting vowel, and the formation of the imperative forms of a verb. There is an established tendency to introduce quite precise and clear algorithms, by which the native speaker of Russian operates, into the consciousness of the student.

In our republic there were many difficulties both in developing the methodology and in creating the material-technical base for teaching the children this new subject. But these difficulties are gradually being surmounted.

Now we are charged with implementing general education in electronics, mastering programming and becoming familiar with the concepts of a much

bigger world, which the teacher and his students will model on the computer. This education will tell teachers why the computer is necessary to the student in the sciences, to the engineer in his technical work, to the worker for his production. And this education will discuss the language models which are in wide use in scientific prediction.

We live in an era in which formation of the cybernetic style of thought and of a broad outlook is becoming essential. One of the aims of people who work in informatics is to achieve a maximal absorption of culture, in the broadest sense of the word. And each teacher, including those in the humanities, must find a means of self-perfection. He must know everything about today's informatics and about the prospects for this young, rapidly-developing science. It is impossible not to know this, as informatics has entered into the class schedules of every school, gathers strength, and wins over minds and inspires upperclassmen--the avant-garde of computer education.

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ROBOTRON-1720 IN TRAINING CENTER

Yerevan KOMMUNIST in Russian 1 Nov 86 p 4

[Photo caption, unsigned. Photo not reproduced]

[Text] With the installation of the new-type, universal machine "Robotron-1720" the sphere of activities of the Gorisskiy Information and Computation Center has expanded. From the beginning of the school year students from regional schools and professional and technical colleges began to visit the Robotron room. A specialized course was organized for them here with practical studies on the topic: "Computer Technology and Informatics." Refresher courses are run for the teaching staffs of general studies schools and colleges.

The "Robotrons" have assumed the functions of the compilers of menus for pre-school institutions and other duties.

In the photograph: At the "Robotron-1720" are operator A. Mkrtchyan (on the left) and Senior Engineer T. Arutyunyan.

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